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THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. JUNE 8, 1899. CHICAGO, ILL. NUMBER 23

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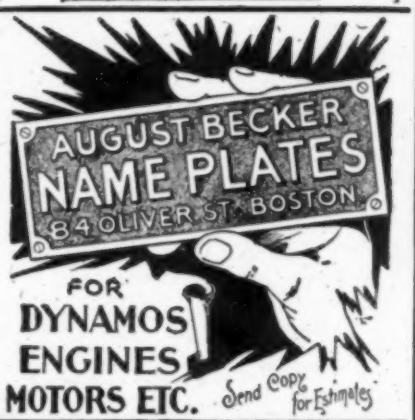

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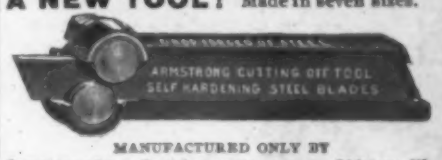

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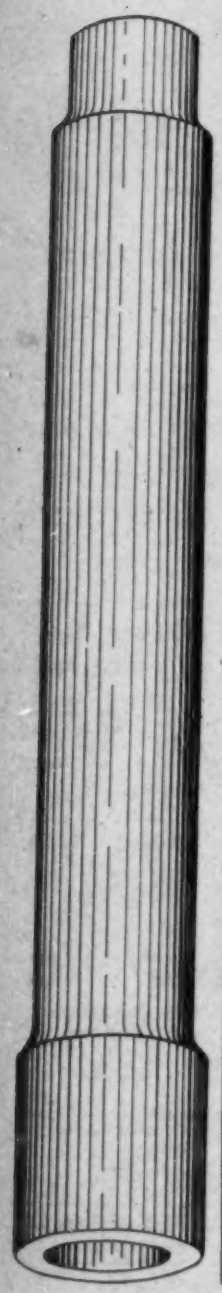

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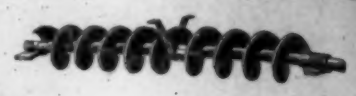

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THE IRON TRADE REVIEW

VOLUME XXXII. CLEVELAND, O. JUNE 8, 1899. CHICAGO, ILL. NUMBER 23

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

Another exciting week has passed in the iron trade, with advances in nearly all lines, and demand apparently unchecked by high prices. It is significant that contracts are being made with every week, that extend into 1900, some consumers of pig iron having supplied themselves for from three to six months of next year at prevailing prices. Stocks are being cut down with every day; and though the trade appreciates in a sentimental way that high prices eventually mean curtailed consumption, there is nothing in the situation as yet on which to base the statement that flood-tide has been reached. The trade is surprising itself, week by week, with the breadth of the movement and the confidence with which contracts are being entered into at figures in many instances quite beyond rejected offers of recent weeks. The malleable trade in the Chicago district alone is reported to have taken over 100,000 tons in the past fortnight, deliveries extending over six months and nine months. Advances in castings are now being secured by foundrymen more in conformity with the new prices, in some cases amounting to about ½ cent a pound over the basis of later 1898, the pig iron entering into these contracts being about $6 higher. Unfortunately other foundrymen not fully covered on old work are now compelled not only to pay a high price for iron to complete contracts, but must take irons with which they have had no experience. A fact of no little importance in the present situation is that the export trade is much better sustained than is generally supposed. Statistics of exports show a tonnage in some lines exceeding that of one year ago. In some European markets, through advances in Great Britain and Germany, American iron has been sold recently at prices close to those ruling at home. In finished lines, notably wire and nails, American producers have been taking all the business their energetic foreign representatives have offered, and have steadily cultivated this trade throughout the advance. A study of the iron and steel export exhibits in recent months should be convincing evidence of the future influence of foreign trade in sustaining the home market in times of reaction. It will prove instructive also to those who have been inclined to think that prosperity for the American iron trade could only be short-lived. Practically the whole list of quotations in iron and steel products has required revising in the past week. Southern No. 2 foundry is now $13 Birmingham, and gray forge is $11.75. Northern foundry irons are from 50 cents to $1 a ton higher. The indications of a shortage are more distinct. The additional furnaces seem likely to make no marked impression. Demand, which no man can measure, continues to upset calculations. The structural mills have made an advance of $5 a ton, and are yet scarcely in line with other products. Four 500-ft. vessels placed the past week at a Lake Erie shipyard, and calling for 10,000 tons of material, mark another step in great ore-carrying capacities. The expected advance in wire and wire nails has been made—25 cents on 100 pounds, with demand in all departments of this trade steadily sustained. There has been some interest in the trade in the open-hearth steel and wire-mill projects at Birmingham. In the present state of the trade in basic iron it is questionable if any Alabama product will be available for local steel works. At all events the making of steel or of rods at the Birmingham plants is likely to be much delayed. Bar iron has advanced to 1.70c at Mahoning valley mill, and a fruther early advance is expected.

PITTSBURG.

OFFICE OF *The Iron Trade Review and Industrial World.*
705 PUBLICATION BUILDING, June 7.

The market continues its steady advance toward higher prices. During the week under review there has been a general strengthening of values, and as the firmness in the general situation becomes still more pronounced there can be found fewer and fewer who will venture to make predictions as to where the movement will stop. It seems plain that the general strength of the market cannot be broken this year, or even early in next year, while in any case prices cannot for a long while reach the low points made in the past, because labor and raw materials cannot soon get down to the level prevailing when the record figures were made.

There will certainly be no more ore than sufficient to run furnaces—even should a few shut down—up to the opening of navigation next year, and there are chances that a shortage will be developed. There is now only a limited quantity of unsold Bessemer pig for the balance of this year, estimated by some at less than 100,000 tons, from furnaces in and out of the association, and the demands of the steel mills will require a considerable quantity yet. Very little increase in production may be expected from now on, in Bessemer, outside of the Douglas furnace, which it is now expected will be blown in about the end of the week, the raw materials being on the way, and the furnace being in condition for immediate blast.

PIG IRON.—The minimum for Bessemer pig iron is $18 valley furnace, or $18.65 Pittsburg. A small tonnage has been sold on this basis in the last few days. The associated furnaces have very little iron to sell; in fact, at the recent meeting it was figured that they had no more than 60,000 tons for the balance of the year, and to sell this quantity it was admitted some deliveries might have to be deferred to January. There may be an equal quantity of Bessemer coming from outside sources. In foundry iron the market has been rather quiet, but the actual demand has strengthened prices by about 25 cents a ton since last report. In mill iron prices are also considerably firmer. We quote:

Bessemer, valley furnace	18 00		
Bessemer, Pittsburg	18 65		
No. 1 Foundry	16.75	to	17.05
No. 2 Foundry	16.50	to	17.00
No. 3 Foundry	16.00	to	16.20
Gray Forge, valley furnace	15 00	to	15.55
Gray Forge, Pittsburg	15 50	to	15 70

STEEL.—Nearly all the mills are practically sold up to the end of the year What demand has materialized has forced the price steadily upward for what lots could be secured, and to-day $31 Pittsburg is the minimum, while sales have been made at higher figures than this. Open-hearth steel is unquotable. It is probable that there is a fair tonnage still required, and it is decidedly uncertain whether it can be secured. There have been some sales of sheet bars at considerably over $30 a ton, the sheet mills being able to realize such a figure for their product that they are willing to pay almost any price to get the steel.

RAILS AND TRACK MATERIAL.—The rail market is wholly a nominal one. Track material is very firm and there is a fair tonnage being booked at former prices: Spikes, 1.90c to 2c; track bolts, 2.30c to 2.45c; splice bars, 1.75c to 1.90c; links and pins, 2c to 2.15c.

BARS.—Both steel and iron bars are very firm, steel bars selling at 1.90c to 2c, and iron bars at 1.70c to 1.80c.

STRUCTURAL MATERIAL.—At the meeting last Thursday in New York, the price of all structural material was advanced by $5 a ton. It is expected that for business yet to be placed the advance will not act as a deterrent, since about all the large work contemplated for the season has already been contracted for. The new prices are as follows: Beams and channels, 3 to 15 inches, 1.75c; 18 to 24 inches, 1 85c; tees, 1.80c; zees, 1.80c; and angles, 1.75c. Universal mill plates, 2.25c.

PLATES.—The plate market continues very firm and the prices asked are readily agreed to. We quote prices unchanged as follows: Tank, 2.25c; shell, 2.35c; flange, 2.45c; fire box, 3¼c to 3¾c.

PIPES AND TUBES.—The National Tube Co. will not begin actively to administer affairs for two or three weeks yet. What selling is being done is through the old channels, but there is such a scarcity for deliveries up to September that it is difficult to place orders. Some of the producers are entirely out of the market except for September and later deliveries. For special deliveries the straight 60 per cent off has been secured, and 60 and two 10's is freely offered for early delivery in moderate lots. The balance of the list is in about the same shape so that the scheduled discounts are only nominal: Base discount, 60 per cent and additional discounts three 10's for less than carloads and three 10's and 5 for carloads, with free delivery on the latter within the prescribed territory; lap weld casing, 45 for screw and socket joint and 40 for inserted joint, with 5 per cent additional on carload orders; boiler tubes, 1¼ to 1½-inch, 40 per cent; 1¾ to 2½-inch, 50 for iron and 55 for steel; 2¾ to 6-inch, 55 for iron and 57½ for steel; extra 5 per cent to dealers.

SHEETS.—The sheet market has been more active than formerly, mills having been able in the past few weeks to secure considerable quantities of bars. The selling has been on the basis of 2.90c to 3c for No. 28 common. Galvanized sheets are strong and we quote the market at 70 and 10 per cent off to favored customers in large lots, while the general run of business is being done at 70 and 5 and 70 off. A conference is being arranged on the wage scale between the workmen and the executive committee of the Steel Sheet Manufacturers' Association, it having been found that the sheet consolidation cannot be perfected in time to allow the new organization to negotiate the matter.

SPELTER.—This market has shown its first sign of weakness for some time, although the decline has not amounted to much. St. Louis quotes 6.35c to 6.40c; Pittsburg, 6.55c; and New York, 6.55c to 6.60c.

OLD MATERIAL.—There is no particular change to note in this line. Quotations remain as follows: New melting stock, $13.50 to $13.75; old steel rails, long lengths, $12.50 to $13; cut, $13 to $13.50; old iron rails, $17 to $17.50; wrought iron scrap, $14 to $15; cast borings, $8, net, Pittsburg; busheling scrap, $11 to $11.50, net; car wheels (nominal), $14 to $14.50, gross; cast scrap, $12, gross; charcoal scrap, $13, gross; wrought turnings, $8.50 to $9, net, Pittsburg.

COKE.—The coke market is very firm, and all of $2.15 is secured for strictly Connellsville furnace coke, with crushed and foundry selling at $2.15 to dealers and $2.30 to consumers. Transactions in the past week have been of very moderate volume. Production is increasing even over the rapid pace recently set. The shipments of the H. C. Frick Coke Co. during the month of May amounted to 32,505 cars, beating the previous month, which was last March, by 100 cars. Both months had 27 working days, but allowance should be made for the fact that of the 27 days in May one was Memorial Day, on which full time was not made, which further strengthens the comparison in favor of May.

CHICAGO.

Office of The Iron Trade Review and Industrial World.
1522 MONADNOCK BLOCK, June 6.

There have been very decided advances in steel products during the week just ended. It has been largely a lining up of quotations in harmony with the increased values of crude steel, which have been the features of the market for several weeks. Structural shapes are up $5 per ton. Merchant steel is higher. Track supplies are quoted at a better figure. Wire and nails are from $5 to $10 per ton higher. And for a large variety of finished products values have been established on a new basis, to conform to these advances. Buying has been of a general character and in volume more than satisfactory to the sellers. Pig iron has shared in the activity and is stronger in tone than a week ago. There are in some directions distinct evidences of reluctance on the part of consumers to load up at the present level but this backwardness is not of sufficient dimensions to detract from the general strength of the market. It is rather a problem for the buyers who are willing to close ahead for their wants, to secure the desired deliveries.

PIG IRON.—Pig iron can yet be purchased at the minimum quotations of a week ago. But nevertheless there is not a little iron being sold at prices above the maximum quotations. There is in fact wide divergence of prices, and for this condition of the market the scantness of stocks for present delivery is made responsible. Melters are willing in some cases to pay any price that is asked in order to obtain the necessary iron. There has been further buying of malleable iron during the week that is passed. Most of the large buyers have covered their estimated needs for the balance of the year and there have also been heavy trasactions for delivery during the first six months of 1900. A number of country foundries, however, are still in the market for moderate amounts. There are at least a number of melters who are buying more sparingly than a year ago, not because of an estimated reduced consumption but through a willingness to take chances on a portion of their needs in future markets. The late buying has been of moderate lots and for deliveries of all sorts. The aggregate has been large. We quote for cash, as follows:

Lake Sup. Charcoal	$18 00	$20 00		Southern Coke No. 3	$15 50 @ $15 75
Local Coke Fdy. No. 1	16 50 @ 17 00			Southern No. 1 Soft	16 50 @ 16 75
Local Coke Fdy. No. 2	16 00 @ 16 50			Southern No. 2 Soft	16 00 @ 16 25
Local Coke Fdy. No. 3	15 50 @ 16 00			Southern Silveries	16 50 @ 16 75
Local Scotch Fdy. No. 1	17 00 @ 17 50			Jackson Co. Silveries	19 00 @ 20 00
Local Scotch Fdy. No. 2	15 50 @ 16 00			Ohio Strong Softeners	19 00 @ 20 00
Local Scotch Fdy. No. 3	15 00 @ 15 50			Alabama Car Wheel	18 50 @ 19 00
Southern Coke No. 1	16 50 @ 16 75			Malleable Bessemer	17 50 @ 18 00
Southern Coke No. 2	16 00 @ 16 25			Coke Bessemer	18 00 @ 18 50

BARS.—Prices for both iron and soft steel bars are higher this week. Quotations are not uniform but for mill shipments common iron is quoted at about 1.80c to 1.95c. There is continued good buying. Some large transactions have been closed in iron bars and the trading, which for a month or six weeks prior to May 1 had been withheld, has developed during the past few weeks into a larger tonnage than had been anticipated. Conditions are now said to be very good for a continuous operation of the iron mills for many months to come. Steady operation throughout the year is almost assured. In consequence of this and the fact that steel is rising so sharply iron bars are higher in value. Soft steel bars also are higher. A common quotation is 2.05c, but it is not certain that desirable lots can be bought below that figure. Hoops and bands are without further change in value this week.

STRUCTURAL MATERIAL.—An advance of $5 per ton has been made in the entire range of shapes. There has been a good aggregate tonnage of material sold during the week but it has been mainly in small lots. We quote: Beams, 15 inches and under, 1.90c to 2c; 18 inches and over, 2c to 2.10c; angles under 3 inches and over 6 inches, 2c to 2.10c; 3 inches to 6 inches, 1.90c to 2c; sheared plates, 2.65c to 2.70c; universal plates, 2.65c; tees, 1.95c to 2c; zees, 1.95c to 2c. Small lots from store are quoted ¼c to ½c higher.

PLATES.—Consumers are buying for deliveries as distant as next February, and for that date are able to get in some instances a concession of about .20c under the present quotations. But for near shipments the situation is as strained as ever. Prices are upward in tendency and considerable work is being delayed by the inability of the consumers to obtain the needed supplies of material. Tank steel from stock is quoted 2.75 to 3c. Mill shipments, Chicago delivery, are quoted as follows: Tank steel, 2.65c; shell, 2.75c; flange, 2.85c; marine, 2.95c; fire box, 3c to 5c, according to brand.

MERCHANT PIPE.—Mills continue to decline making quotations and are even backward in responding to the specifications made on old contracts. For boiler tubes there is steady demand and prices are equally steady.

SHEETS.—Galvanized sheets are quoted higher at 70 and 5 from mill, and 70 from store. Sales are large. Black sheets are less active on account of the indifference of mills to make quotations. No. 27 is quoted 3c to 3.15c.

MERCHANT STEEL.—An all around advance has occurred this week in merchant steel. The demand continues large and mills are disposed to discourage trade. Some large contracts, however, have been placed for deliveries extending some distance into the future. We quote smooth finish tire steel, 2.35c to 2.45c; smooth finish machinery steel, 2 55c to 2.65c; spring steel, 2.80c to 2.90c; tool steel, 6c to 7.50c; special, 10c and upwards.

BILLETS AND RODS.—The nominal value of billets is $30 to $32, but no transactions are reported. Rods are moderately active at about $38 per ton.

RAILS AND TRACK SUPPLIES.—Mills are busy on their long booked orders and are not in a position to add materially to their engagements for the present season. Purchases are therefore on a small scale, as compared with present output. Track material has again advanced in price. Standard rails are quoted $26 to $28; light rails, $30 to $37. Splice bars are 1.70c to 1.75c; spikes, 2.25c to 2.35c; track bolts, 2.85c to 3.25c.

OLD MATERIAL.—The large buyer here is said to be very well supplied with scrap and is moving from one mill to another the existing supplies, when needed. But there is nevertheless a constant and very fair trade in all kinds of old material. Prices are fluctuating to some extent but the market is generally steady. We quote dealers' prices:

Old iron rails, gross,	$17 75@$18 00	Axles, net	$18 00@$19 00
Old steel rails, long, gr.	13 00@ 13 50	Cast borings, net	6 00@ 6 50
Old steel rails, mixed	12 00@ 12 50	Wrought turnings, net	8 50@ 9 00
Old wheels, gross	15 00@ 16 00	Axle turnings, net	9 00@ 9 50
Railroad forge, net	15 50@ 16 50	Mixed steel, gross	8 50
Dealer's forge, net	12 00@ 12 50	Stove plates, net	7 00@ 7 50
No. 1 mill, net	8 75@10 9 25	Heavy melting steel, gr.	11 00@12 00
Heavy cast, net	10 50@ 11 00	Old iron splice b., net.	17 50@18 00
Malleable cast, net	8 00@ 8 50		

WIRE AND WIRE NAILS.—The expected advance in wire and wire product has come this week. Wire nails are now quoted at $2.60, Chicago, in car lots, and $2.70 less than car lots. Wire is $5 per ton higher and current quotations are as follows: Plain annealed wire, $2.45; painted barb wire at $2.70; galvanized barb wire, $3.20.

CLEVELAND.

OFFICE OF *The Iron Trade Review and Industrial World.* }
27 VINCENT ST., June 7. }

The iron ore movement to June 1, so far as figures are available, has been a surprise in its size. The ports heard from that fall short of last year's record, are only slightly behind, and in other cases the 1898 figures to June 1 have been exceeded. Two Harbors sent down 513,000 tons in May, against 353,000 tons in May last year. Wild rates are strong and with the big loads modern boats can carry vessel men are getting some share of the going prosperity. From the head of the lake 75 cents is paid, from Marquette 70 cents and from Escanaba 65 cents. Shippers are not holding off because of the substantial advances over the June rates that have obtained for several years, and the indications are that this level will be maintained for some time. Meantime vessels are getting better dispatch at Lake Erie ports than was the case a year ago. More ore is going direct and the ore that goes on dock is being promptly handled, so that there is comparatively little holding up of vessels.

Pig Iron.—It is getting more difficult to represent the market on pig iron by quotations. As the situation appears to grow more unmanageable, sales come about more through negotiations that recognize the past relations of buyer and seller and the conditions attending each transaction, than in accordance with any uniform movement of prices. There has been from 50 cents to $1 a ton advance in foundry iron in the week, as indicated by certain reported transactions. But there is wide variation. A sale of 1,000 tons of No. 2 foundry has been made in the week at $16, valley furnace, but this is below the average, sales being reported at $17 and $17.50; and as high as $18 is named for one lot of spot iron. The amount of foundry iron from furnaces represented in Cleveland offices, that is available for 1899 shipment, is getting so small that sellers are doing the closest figuring in each instance to make sure that they can safely add to their engagements the amount asked for. Some furnaces are out of the market for the time being, requiring the help of actual operations in the next month or two to determine what they can sell for the last four or five months of the year. Gray forge iron has advanced, with little to be had, and transactions are reported at the equivalent of $15.35 valley furnace, with $15.50 quoted to-day. The situation in Bessemer iron is unchanged. Furnaces are not naming a price at which their executive committee may sell even limited amounts. Some offers are received from dealers, and some iron was bought in the past 10 days at $17 furnace by an important interest that had refused $16 iron in the week preceding. We quote $18 valley. Our quotations f. o. b Cleveland represent a wider range than heretofore:

Bessemer	$18 25@18 50	Valley Scotch No. 1	$17 50@18 00
No. 1 Strong Foundry	17 25@18 00	Valley Scotch No. 2	17 15@17 65
No. 2 Strong Foundry	17 00@17 50	Gray Forge, valley	15 50
No. 3 Foundry	16 50@16 90	Lake Superior Charcoal	19 00@20 00

FINISHED MATERIAL.—The upward movement continues in nearly every line. The advance in structural material, which is $5 a ton on all forms—beams and channels, angles, tees, zees, etc.—brings beams to 1.75c, Pittsburg, which is still below, relatively, the figures for bars, plates and other products on which there is no attempt to fix prices by producers' agreement. There are good tonnages of shapes on the books of the mills at 1.50c and lower prices, some recent business being 2,500 tons of shapes for four 500-ft. vessels just placed by A. B. Wolvin with the American Shipbuilding Co. This business was taken by the leading Pittsburg interest. The plates for these boats are said to be covered by options of some time back. An advance in bars has been made in the week and 1.70c valley mill is the minimum quotation for iron, in carload lots, 1.85c being quoted for smaller lots. A further advance in the quotation of the leading producer of bar iron is looked for. Steel bars are 2c Pittsburg with deliveries in the last quarter the only available ones with some mills. Sales have been made of open-hearth material of certain sizes at from 2c to 2.25c, Pittsburg mill on smaller contracts. The demand appears not restricted by the advances thus far. Sheets are little changed in the local market, and we quote 2.90c to 2.95c, Pittsburg, for No. 27 common black, and 70 and 5 off for galvanized. Merchant pipe is firmer in dealers' hands, some of the mills being out of the market. The condition as to plates is more stringent, 2.25c being the minimum for tank and higher prices offered for early delivery, and where old plant is being prepared for starting up a limited tonnage can be taken.

OLD MATERIAL.—The prices quoted last week are applicable to current transactions, with the market firm in view of the advances in pig iron and nearly all finished materials: No. 1 railroad wrought scrap, $16 valley mill; busheling scrap, $12.50; old iron rails, $19.50 to $20; old steel rails, $14.50 to $15. In the Cleveland market machinery cast scrap is quoted $12.50; cast borings, $8.50; grate bars, $8 to $8.50; stove plate, $8.50; old car wheels, $16.

WIRE AND WIRE NAILS.—An advance of 25 cents a keg from base has been made in wire nails, and a corresponding advance in wire. At Pittsburg mill, freight added for Cleveland delivery, the price to jobbers in carload lots is now $2.35 for nails, with usual advances to retailers and on smaller lots to jobbers. Plain annealed wire is $2.20, Pittsburg, to jobbers in carload lots; painted barb wire, $2.45, carload lots; galvanized, $2.95, carload lots.

CINCINNATI.

June 6.

Another very busy week has passed and prices have been on the jump again. It is becoming more and more apparent that during the last six months of this year there is going to be an actual shortage in the supply of pig iron. Selling firms report that consumers are already asking to be given iron as a favor. There is no perceptible let up in the demand. The inquiry is now almost altogether for shipments during the last six months of the year. No. 2 foundry has gone to $13 at Birmingham and gray forge has advanced to $11.50. The agricultural implement men are the only class of consumers in the country who are displaying any nervousness over the future. The reports of bad crops are disturbing them, for their business is dependent, of course, entirely on the farmers, and a year of bad crops means a sharp curtailment of other sales. The fact of the matter is apparently that in some sections winter wheat is very bad, but other crops may more

than atone for this partial failure. A number of the Southern furnaces are absolutely out of the market for deliveries this year. We quote for cash f. o.b. Cincinnati: Southern coke, No. 1 foundry, $15.75to 16.25; No. 2, $15.25 to $15.75; No. 3, $14.75 to $15; No. 4 and gray forge, $14.25 to $14.75; mottled, $14.25 to $14.75; No. 1 soft, $15.75 to $16.25; No. 2 soft, $15.25 to $15.75; Lake Superior coke, No. 1, $16.75 to $17.25; No. 2, $16.50 to $17; Hanging Rock charcoal No. 1, $21 to $22; Jackson Co. silvery No. 1, $19.50 to $20; Standard Georgia car wheel, $16.75 to $17.50; Lake Superior charcoal, $20.50 to $21.

PHILADELPHIA.

June 6.

An advance of 50 cents a ton last week in Northern iron had no tendency to restrict business. There is now no attempt to predict the end of the present movement. It is already deeper and stronger and gives more signs of permanence than even optimistic members of the trade would have been willing to predict even a few weeks ago. There is no disposition to do anything but take the market as it is. To day's quotations will probably not answer for the end of the week. Sales keep up both for extended and near-by delivery, and the furnaces are only embarrassed by the problem of figuring out deliveries of the iron sold. It is a question of getting buyers to take less than they set out to get We quote No. 1X foundry $17.50 to $18; No 2X $17.25 to $17.50; No. 2 plain, $16.50 to $16.75; gray forge, $16; basic iron, $17 to $17.50. In billets there is a good deal of inquiry, but little steel for sale. The price is nominally $32. Rolling mills and steel works are not only pushed to the utmost, but are in many cases further behind than ever. There is no trouble about getting $2 to $4 a ton extra for any form of material where early delivery will be made. The great trouble is to find sellers. The advance in structural material puts beams and angles up to 1.88c as minimum and zee bars and tees to 1.93c. We quote tank plates at 2.50c to 2.60c; refined bar iron, 1.70c to 1.75c. Old material is unchanged at $18 to $19 for choice railroad scrap; $13 to $14 for No. 1 yard scrap; $13 to $13.50 for machinery cast scrap; $18.50 to $19 50 for old iron rails, and $14.50 to $15 for old steel rails; $15.50 to $16 for old car wheels.

FOUNDERS AND MOLDERS IN CONFERENCE.

An important conference of foundrymen and union molders was held at the Hollenden Hotel, Cleveland, on Monday and Tuesday, June 5 and 6. There were present seven representatives of the National Founders' Association and seven officers of the Iron Molders' Union, including President Fox, Vice-president Valentine and Editor Black, of the *Iron Molders' Journal*, Cincinnati. The foundrymen were represented by President O. P. Letchworth, of Buffalo, and Secretary John A. Penton, of Detroit; Wm. Pfahler, Philadelphia; H. N. Covell, Brooklyn, N. Y.; C. L. Newcomb, Holyoke, Mass.; C. A. Bauer, Springfield, O.; H. M. Leland, Detroit, and J. A. Stone, of Cleveland. Secretary Hogan, of the Stove Founders' Defense Association, was also present, but not as a member of the conference. The questions under discussion grow out of the strikes now on in foundries at Providence, R. I., and Worcester, Mass., and their settlement through conference is a part of the general scheme of amicable adjustment of such troubles, recently adopted by the National Founders' Association and various local associations of foundrymen on the one hand and the Iron Molders' Union on the other. The Providence and Worcester foundries are for the most part outside the National Founders' Association.

The questions raised are not alone of local significance. Their decision will have a bearing on the foundry trade at large, not only union shops, but open and non union establishments, through the moral effect of a decision acquiesced in by representative employers. The more important issues are those of a minimum wage, abolition of piece work in machinery foundries, and recognition of the union. On the two latter the conference came to no conclusion. The matter of a minimum wage was referred to a committee, composed of two representatives from each organization, who were asked to report for action a minimum schedule taking in the various classes of castings.

While little is given out concerning the conference, it is significant of the changed condition in the foundry trade that promises to reduce to a minimum the bitter and expensive conflicts that have been so common between founders and molders. In the two shops in Providence and Worcester belonging to the proprietors' association the molders have been at work through the trouble, in accordance with an agreement existing between association shops and the Iron Molders' Union.

WAGE SCALE CONFERENCES.

This week and next the opening conferences on the various wage scales will be held to govern wages in the mills controlled by the Amalgamated Association. The first bar iron conference is appointed for Detroit June 7 and 8. The opening conference on the tin plate scale will be held the middle or latter part of next week, and the initial conference on the sheet scale will be scheduled for Wednesday or Thursday of next week. The advances asked by the workers are very heavy and it is not at all probable that the manufacturers will concede what is asked, though they are willing to make moderate advances. In the sheet scale the usual demand will be made of a restoration of the wages existing before the 10 per cent reduction was made in 1893, with an additional advance beyond this for the shearmen, and corresponding advances in the sheet mill hands' scale, besides some changes in the foot notes. In the tin plate scale still heavier advances are to be asked, covering an advance of 15 to 20 per cent in the base rates and a change in the sliding scale clause, besides some changes in the foot notes. The usual demand for a blackboard will be made. It has been erroneously reported that in the sliding scale paragraph the steel basis was to be changed to a short ton of tin plate bars. The long ton of bars is proposed, and not the short ton.

The sheet mill conference will be held in Pittsburg probably next Wednesday. Three vacancies in the executive committee of the manufacturers' association due to the absorption of certain mills by the American Tin Plate Co. have been filled by the appointment of Jeremiah Reeves, of Reeves Iron Co., Canal Dover, O.; J. Warner, of the Struthers (O.) Iron & Steel Co.; and R. J Beatty, of the Midland Steel Co. The remaining members are A. W. Brown, of the Cambridge (O.) Iron & Steel Co.; B. M. Caldwell, of the Aetna-Standard Iron & Steel Co.; N. E. Whitaker, of the Whitaker Iron Co , Wheeling; J. G. Battelle, of the Piqua (O.) Rolling Mill Co.; and John Jarrett, secretary.

The conference on the wage scale to govern the tin houses of the American Tin Plate Co. is being held in Chicago this week, at the company's offices, the workers' representatives being George Powell, president of the workers' organization, which is known as the Tin Workers' International Protective Association, T. F. Berry, W. O. Moore, John Romboldt, Hugh J. Scanlon, Charles Lawler and L. S. Harris. The tin plate company is represented by Warner Arms, third vice-president and in charge of the operation of the plants. A scale was formulated for presentation at the recent convention of the association held in Columbus. Heretofore there has been no uniformity in tin house wages, although at one or two of the plants individual scales have been adopted. The workers believe that the control of the whole tin plate business by the American Tin Plate Co. will facilitate the establishment of uniform wages for the tin house workers, which has heretofore been impossible under the individual ownership of plants. It is understood that beyond asking for the recognition of a universal scale, the workers will ask for a very considerable advance over the present average of wages, but in this it is probable that a compromise can readily be effected, as the recognition of the union will constitute in itself a very important gain for the workers.

BLAST furnace employes in the Mahoning valley had a meeting June 3 and will ask that their wages, which have been for years below the New Castle basis, be brought up to the latter. They give the present schedule of wages in the two districts as follows: Mahoning valley—helpers and fillers $1.80; cinder men, $1.80; common labor, $1.35; keepers, $2.10; top fillers, $2; iron carriers, $2.10. New Castle—helpers and fillers, $2; cinder men, $2; common labor, $1.50; keepers $2.50; top fillers, $2.25; iron carriers, $2.75.

LAKE SUPERIOR IRON MINES.

The lease of the Alpena mine by the American Steel & Wire Co. will permit of the most advantageous operation of the company's adjoining mine, the Sauntry. Tracks can now be built so that cars will enter at one end and move out at the other, saving the necessity of backing out with loads. The American Steel & Wire Co. has also taken a lease of the Cuff property on the Menominee range. This is a silicious deposit, located next to the Traders or Antoine, just north of Iron Mountain, Mich. Welcome Hyde, of Milwaukee, is the principal fee owner. The ores taken from various portions of the property run from 35 to 45 per cent in iron, with silica from 25 to 40 per cent; phosphorus as low as .011.

The largest load of ore yet cleared from Two Harbors, was that of the Bessemer schooner John Fritz, last week—6,800 gross or 7,617 net tons on a draft of 17 feet 2 inches forward, and 17 feet 3 inches aft. The Morse, which towed the John Fritz, carried over 6,000 tons.

Alfred Kidder, agent of the Pittsburg & Lake Angeline Iron Co., interviewed at Duluth concerning the Lake Superior ore supply said among other things: "I do not think that new discoveries of high grades of iron ore will keep pace with the consumption. There is a time coming—it may be 25 or 30 years more or less—when we shall have to be content with lower grades, as is the case in other countries, to help out. We have got ore enough to supply the demand of a century or more if we include the low grades, such as contain say 30 or 40 per cent of iron, and which are now not regarded as merchantable. When the time comes that the low grade ores must be pressed into service, American ingenuity will adapt itself to the situation. It is said there is a large amount of titanic ore. Under present methods it is expensive to eliminate the titanium, but when the time comes that cheaper methods become imperative, we may rely on it that they will be available."

The Mikado on the Gogebic range, which Pickands, Mather & Co., of Cleveland, are opening up, is comparatively undeveloped, though the ore body was proved in 1891-2. The first shipment was in 1895 and the total output has been 16,185 tons.

The Oliver Iron Mining Co. is placing a large triple expansion pump of the Fred. M. Prescott type, in No. 3 shaft of the Riverton mine at Iron River. The Prescott pump is rapidly gaining a foothold.

A steel shaft house will be erected at the Adams mine, at Eveleth, Minn. It will be patterned after the one at B shaft of the Aurora mine, thus far the only steel shaft house in the Lake Superior district.

At the Kanawha mine near Biwabik, stripping has uncovered a large body of ore.

The Oliver Iron Mining Co. has taken an option on the Taylor property, five miles south of L'Anse, Mich.

Corrigan, McKinney & Co., of Cleveland, have taken the Ironton, Puritan and Federal mines in the Bessemer, Mich., district. These mines are in the direct line of the vein crossing the Palms, Tilden and Colby properties.

Car Wheel Companies Consolidate.

The International Car Wheel Co. has been incorporated under the laws of New Jersey with an authorized capital of $15,000,000. It includes important plants in the Northeast and in Canada, the combined capacity of which is at present 1,500 car wheels a day, and a large part of whose trade is with street railroad companies. The plants are as follows: New York Car Wheel Works, with plants at Buffalo, New York City and Philadelphia; Swett Car Wheel & Foundry Co., Boston; Boston Car Wheel Co., Boston; Ramapo Car Wheel Works, Ramapo, N. J.; St. Thomas Car Wheel Co., Ontario, Can.; Hamilton Wheel & Foundry Co., Montreal; John McDougall & Co., Montreal; Weston Furnace Co., Manistique, Mich. (manufacturing charcoal pig iron), and Pittsburg Car Wheel Co., Pittsburg, Pa. Of the capital of $15,000,000, $5,000,000 is to be 7 per cent cumulative preferred stock. The temporary officers are located in Buffalo. They are: P. H. Griffin, president, and chairman of the board of directors; T. G. Smith, vice-president, and Warren P. King, secretary and treasurer. Later, headquarters will be estblished in New York. The directors are: P. H. Griffin, Buffalo; T. G. Smith, Buffalo; J. F. Pierson, Ramapo, N. Y.; A. D. Basson, Boston; T. J. Drummond, Montreal; Edgar McDougall, Montreal; Herbert L. Satterlee, attorney, New York; S. Singer, Paris, France; Robert Cowans, Montreal; A. E Domville, St. Thomas; Warren P. King, Buffalo; John Fleming, Brussels, Belgium; H. K. Wood, Jersey City, and C W. Barnum, Lime Rock, N. J.

Four New Lake Vessels 500 Feet Long.

A contract has just been let by A. B. Wolvin, of Duluth, to the American Shipbuilding Co., the new consolidation of lake shipbuilding companies, for four steel steamers 500 feet long, to be delivered at the opening of navigation in 1900. The vessels will be built at the Lorain shipyard, formerly owned by the Cleveland Shipbuilding Co. The new steamers will be the largest on fresh water and the first 500-ft. boats on the lakes, the next largest being the 490-ft. steamer of the Bessemer fleet contracted for delivery next season. The keel length of the four steamers will be 478 feet, with 52 feet beam and 30 feet molded depth. They will have quadruple expansion engines, cylinders 17, 25½, 39 and 60 inches by 40-inch stroke. Steam will be furnished by water tube boilers, to be allowed 250 pounds of steam. The boats will have 15 hatches and all the latest improvements. They will carry 8,000 tons on 18 feet of water. The cost will be $350,000 each, or $1,400,000 for the four. The owners of the new vessels are not disclosed, though it is supposed Mr. Wolvin is acting for others, presumably one of the large steel consolidations.

The Buffalo Steel Plant.

John J. Albright, of Buffalo, who has bought the land for the proposed steel plant at Stony Point, just south of the city limits of Buffalo, and extending along the lake front, says that the capital has been fixed at $20,000,000. Of this amount there is $2,500,000 subscribed in Buffalo. Walter Scranton, of the Lackawanna Iron & Steel Co., is the prime mover in the enterprise, but thus far he has not given out the names of his associates. It is expected that four or five months will be required for making the plans and that it will be two years before the plant will be in operation. An application is to be made at once to the State railroad commissioners for a certificate of necessity for the South Buffalo Railway Co., which will run from Stony Point to West Seneca over the steel company's lands. While no name for the new company has been determined upon, it will probably be known as the Buffalo Steel Co.

A LITTLE item appeared in a Pittsburg paper a couple of weeks ago, announcing the resumption of work by an abandoned mill. The next morning the new owner of the plant was visited by a gentleman, tendering an order for 75,000 tons of plates, running over two years. Every existing mill has orders sufficient to run it until the late fall. Prices are moving upward daily, and the seller can dictate prices. We hesitate suggesting where prices will go.—[Boiler Maker.

A COMMITTEE of the boiler manufacturers and others connected with the trade held an informal meeting at the Hollenden Hotel, Cleveland, on Monday evening, June 5, to make preliminary arrangements for the annual convention of the American Boiler Manufacturers' Association, to be held in Cleveland some time in the next four months, the date being yet undetermined.

PLANS are being made for additional coke ovens of the Semet-Solvay type, at the Riverside Iron Works plant at Benwood, W. Va. There are now 60. The new plans call for 80 more.

STOCKS in the American Pig Iron Storage Warrant Co.'s yards May 31 were 67,300 tons, the withdrawals in the preceding 11 days being 7,000 tons and the amount put in yard, 900 tons.

The Pittsburg Steel Foundry Co., which is erecting a plant at Glassport, has left an order for 500 h. p. engines to be built by the Fischer Foundry & Machine Co., of the South Side.

THE IRON TRADE REVIEW
AND
INDUSTRIAL WORLD.

DEVOTED TO MACHINERY, METAL-WORKING AND FOUNDRY TRADES AND IRON AND STEEL MANUFACTURE.

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CAUSES OF OUR INDUSTRIAL ADVANCE.

The subject is a familiar one, made particularly so of late by the flood of comment from British sources, on the trade victories of American manufacturers in various lines of operation in which Great Britain has felt American competition most keenly. There is a deal of study given just now, not only in Great Britain, but in Continental Europe, to the outcome, in terms of world commerce, of the wonderful industrial achievements of the United States. And the agitation of retaliatory tariffs and other special expedients to arrest the campaign of the United States for the trade of all the continents is only one expression of the interest, hostile and friendly, that is being taken in the characteristics of industrial America. Perhaps one of the most philosophical studies in this direction is the lecture delivered some time ago before the Association of Engineers and Architects at Vienna by Karl Wittgenstein, who has been well called "the Andrew Carnegie of Austria." After a more than ordinarily careful study of American affairs, and particularly of the forces that have entered into the American character, he prepared a paper on "The Causes of the Development of Industry in America." It has been reprinted in pamphlet form and would fill about 10 pages of *The Iron Trade Review.* The author is evidently a keen observer and a trained analyst, and his paper reveals a surprising appreciation of the influence of American history and American environment upon the present industrial status of this country.

We shall want to quote from the paper more at length in a later issue; but will take the space here to refer to Mr. Wittgenstein's summation of the elements of our industrial strength. These he finds to be the results of two hard centuries of training in diligence, perseverance and great frugality; of the American people's "healthy, if you like, relentless, egoism;" its desire for education, its speculative spirit, and its great love of liberty. What he means by the speculative spirit the lecturer defines in part in these words:

I have referred to egoism and a desire for education as qualities of the American nation. But it owes its evolution to another gift, without which, in my opinion, a manufacturer is only a bungler. The American has a pronounced love of speculating. I do not mean stock exchange speculators; there are speculators in the better sense of the term. Let me enter into particulars. There are people who imagine a manufacturer to be a man furnished with a certain quantity of technical and mercantile knowledge, who, with the capital he has inherited, builds a factory, and then diligently, quietly and comfortably runs it. I believe there is a considerable amount of error in that conception. The manufacturer must venture, must, if the moment require it, venture everything on one card, even at the risk of not reaping the fruits he hoped for, of losing his stake and being obliged to start in life again. Industry offers no field for quiet, constant, easy-going work, the less so the more developed it is, the more extensive it is, and the more it is dependent on the world market. The wants of single men and single nations are uncertain, and move by fits and starts, and the conditions on which success or failure depends in industry are just so and equally little to be foreseen. Who will presume to foretell what the status of any article will be in the market in the next ten years; what the harvest will be like in America, Russia, Asia; what quantity of cotton or wool will be brought to market; what new inventions will create new wants and make old ones disappear; how many ships will be at sea; whether there will be peace or war? Nobody. And yet the question of the success of industry depends on all these things. In old times business knew nothing of these dangers. It was intended to supply the wants of its own immediate neighborhood, and they could be estimated.

Industry knows no finality, and cannot reckon with any finality. The manufacturer must not only be a mechanician and merchant, and as such able to follow the fluctuations of the market for his productions, but he must perceive the demand for new articles in time, must recognize the value of new methods of working, and also have the courage to adopt them; in a word he must take into consideration a whole series of factors which are not definable, not tangible and often dependent on chance; he must be also a speculator.

This word speculator is offensive to many ears, not alone to the ears of those circles for which mankind begins with the rank of a baron, but also for those circles whose course and habits of life presuppose their having a wide horizon in material things. The word "speculation" is offensive to the ears of those people who have no occasion to risk anything, and therefore, I will not say despise the speculator, but do not consider him their equal. The word "speculator" is offensive to the ears of those who cannot venture anything, win anything, and therefore look on the unexpected gain which another has as obtained by improper means. The word "speculator" offends the ears of those unaccustomed to handle great sums of money and quantities of goods, and who consequently do not know the fall and rise of price in the market, do not know the consequences of such fluctuations and look with distrust and disgust at such persons as are compelled to carry on industry on a grand scale and to deal in the world market. I understand the feeling, and have not come here to glorify the speculator; I shall not make any pyrotechnic show in honor of speculation But one must have the courage to say: A man lacking the speculative mind, a manufacturer without the capacity for taking into consideration besides the visible moments also the uncertain ones lying in the future, and of coming to corresponding decisions, even at the risk of having events turn out quite differently, is unfitted for the management of an industrial establishment.

The quotation serves to illustrate the character of the lecture, which with rare discrimination goes into the less obvious factors in the American advance. It has been the custom to enlarge on the abundance of coal, ores, fertile lands, immigration, great lakes and rivers, in coming at an estimate of the industrial greatness of the United States. But a truthful

statement will contain these plus the results of two and a half centuries of unique history, that has made a unique character. Without dwelling on the point which the above extract brings out so clearly, it may be said that our English friends, in their numerous attempts to diagnose the situation, have utterly failed to take account of the American character and the history that has made it. Too many of their writers, after enumerating natural advantages, have thrown in "American brag and bounce" and called the problem solved. It is a pleasure to read after this successful Austrian and man of affairs, and find in his comments so thorough an appreciation of the real elements of American industrial supremacy.

A good illustration of the superiority of the consolidation over pools or associations as a corrector of trade abuses is likely to be afforded in the Republic Iron & Steel Co. Its policy, as already announced by its officers, includes the strict maintenance of the National card of bar iron extras, the abolition of contracts which do not exactly specify the amount of material to be taken, and the enforcement of the rule of net cash in 30 days. The Bar Iron Association of several years ago, including in its membership most of the companies united to form the Republic Iron & Steel Co., incorporated two of these reforms in its platform, we remember, and made a more or less honest effort to establish them. The result, under the stress of slack times, the necessity of keeping mills in operation, and the multiplied reasons for making concessions in order to get business, is a matter of very vivid memory to the bar iron trade. Open-end contracts may be found on many books to-day, and the manufacturers have regretful occasion to know how amazingly the "requirements" of buyers have grown in these months of advancing prices. To be sure, the proposed reform regulations enforce themselves in times like the present, and the single corporation may not have the opportunity under existing conditions to demonstrate its value, as compared with the old-time association. It will take the period of declining demand to do that. Habituated to the new regulations in a year of marked prosperity, the trade, having but one producer to deal with, and all the old temptations to demoralizing practices removed, may be glad, even in times of reaction and comparative depression, that the market has the support of an interest strong enough to enforce its policy and to make that policy effective to all customers alike.

Personal.

The complete list of district managers of the Republic Iron & Steel Co., a portion of which has been published heretofore, is as follows: W. H. Hassinger, Southern district, office at Birmingham, Ala.; James Campbell, valley district, office at Youngstown, O.; J. C. Corns, Northern Ohio district, office at Massillon, O.; W. L. Simonton, Gas Belt district, office at Muncie, Ind.; Geo. M. Clark, Ohio River district, office at Cincinnati; T. A. Meysenburg, Southwestern district, office at St. Louis; Wm. B. Ridgely, Chicago and Northwestern district, office at general headquarters, Stock Exchange Bldg., Chicago. D. M. Forker, is treasurer for the Southern district and H. W. Heedy for the Valley district. Geo. M. Bard, fourth vice-president of the company, is general purchasing agent, and Geo. A. Baird, formerly of Sharon, Pa., is general sales agent. Y. B. Haagsma is general auditor.

S B E. McVay, of Pomeroy, O., has been appointed general manager of the Brown-Bonnell plant of the Republic Iron & Steel Co., at Youngstown, O., succeeding John I. Williams.

Philip G. Cochran, until recently president of the Washington Coal & Coke Co., and connected also with Brown & Cochran, James Cochran, Sons & Co., and the Juniata Coke Co., died at his home in Dawson, Pa., June 1, of heart trouble, after an illness of three months. In 1894, on the death of his father, James Cochran, he succeeded to the management of the latter's extensive coke interests. Mr. Cochran was 50 years old.

Henry Phipps, of the Carnegie Steel Co., Ltd., is in Europe, and it is reported that H. C. Frick will sail shortly on business with Mr. Carnegie, connected with the new Carnegie Steel Co. organization. The consummation of the plan is not expected for some weeks.

Dr. Richard Moldenke and Geo. S. White, of the McConway & Torley Co., Pittsburg, have resigned, and will shortly enter a wider field in the foundry industry.

Henry Butler, of Youngstown, O., has been made superintendent of the Douglass Furnace, at Sharpsville, Pa. The furnace is about to be started by the Shenango Furnace Co., in which W. P. Snyder, of Pittsburg, and Jos. G. Butler, Jr., of Youngstown, are prominent.

William Mattern, formerly superintendent of the Columbia Iron Co.'s works, Columbia, Pa., has been appointed general manager of the Fullerton Iron Co.'s plant at Fullerton, Pa.

Wm. Smith, heretofore assistant superintendent of the steel plant of the Sargent Co., Chicago, has accepted the position of superintendent of the Aurora Boiler Works, Aurora, Ill.

Senator Hanna, of M. A. Hanna & Co., Cleveland, sails for Europe, June 14.

Samuel Mather, of Pickands, Mather & Co., Cleveland, sails for Europe this week.

President Morton, of Stevens Institute of Technology, Hoboken, N. J., has a letter from Andrew Carnegie saying that he will give $50,000 for the building of the engineering laboratory and chemistry building at Stevens.

Samuel Siddall, heretofore in charge of the sales department of the Union Iron & Steel Co., Youngstown, O., goes to New York to take charge, as general agent for eastern and foreign trade, of the office of the American Steel Hoop Co., 71 Broadway.

Geo. W. Halsted of the firm of Halsted Bros., whose structural iron works are at 388 West Randolph st., died June 4, of pneumonia, aged 30 years.

The *Labor Tribune*, of Pittsburg, gives this summing up of the advances demanded in iron works: The percentages are really more than those stated, in view of the advance in the scale minimum, as noted in these columns last week, the change in the ratio on the tin plate scale and of the percentage of variation due to fluctuations in the prices of tin plates and sheet bars: "Twenty-five per cent on boiling or puddling, with a relative increase in all finishing scales; 20 per cent on tin plate scales; 12 per cent on sheet mill cards, and no less than 10 per cent over present rates on all other schedules, with changes in detail, and foot notes of advantage to the workers."

The Hamilton Machine Tool Co., Hamilton, O., has just completed a large brick addition to be used as an erecting room, pattern shop, drawing rooms and polishing department. The company has all the orders it can fill for six months, while the foreign demand continues to increase also. Some heavy shipments of tools have been made to England, Germany, Sweden and Russia. About $15,000 worth of new machinery has been added to the plant within the last year.

Wm. F. Bonnell, recently appointed sales agent for the Republic Iron & Steel Co, with headquarters in Cleveland, has opened offices on the third floor of the Perry-Payne Bldg.

The contract for forgings for 61 5-inch guns for the Navy Department has been divided between the Bethlehem Iron Co. and the Midvale Steel Co., each bidding 22 cents a pound.

THE PITTSBURG DISTRICT.

James Bonar & Co., 1216 Carnegie Bldg., Pittsburg, have received an order through Atwood & McCaffrey for the Lebanon Furnaces for an equipment of Sweetssteam separators for the new Lebanon plant, consisting of one 15-inch, one 10-inch, one 5-inch, one 6-inch and one 3-inch They are also building two 500 h. p. Pittsburg tubular feed water heaters for the Talladega Furnace Co., Talladega, Ala. Business on the other specialties of the company is excellent.

The Pittsburg Smelting Co. received its charter this week. The capitalization is $25,000. The principal parties interested are Frank N. Schwartz and George Faunce, both of Pittsburg and interested in the Pennsylvania Lead Co., which was absorbed recently by the consolidation. There was some thought of leasing the plant at Carnegie, but this has been abandoned, and a location in the Monongahela Valley will be selected. A plant will be erected as soon as a site is secured. The company will smelt the dross from the local mills, tin, lead, and zinc, to regain the metal. A large part of the dross will come from the tin plate works, galvanizing works and wire works.

The Pittsburg Horseshoe Co., formed some time ago to build a horse shoe plant at Glassport, Pa., has sold the partially completed plant to the American Steel & Wire Co., the latter company being interested in the horse shoe trade through the business in this line secured by the purchase of the Shoenberger Steel Co 's properties.

H. K. Porter & Co., Pittsburg, have taken out a permit for an erecting shop to cost $12,000, and to be located between 49th and 50th sts., adjoining the Allegheny Valley Railroad.

The plant in Pittsburg of the Pittsburg Tool Co , idle for several years, is to be started in operation as soon as possible. The principal parties interested in the company are John L. McCutcheon, of Pittsburg, and R. T. Crane, of Chicago. The plant makes pipe up to 12 inches in diameter and has an annual capacity of about 70,000 tons.

The Park Steel Co., Pittsburg, is erecting a plant adjoining its works for the manufacture of all the crucibles it requires in the manufacture of crucible steel.

An order of 1,000 tons of rails of the new design invented by W. T. Manning, of the B. & O. Railroad, as mentioned some time ago, is being rolled at the Edgar Thomson rail mill for experimental purposes. A new set of rolls had to be cast and turned for the purpose. The new design of rail is for use on curves, the head extending out on one side of the web farther than on the other. The rolling of such a section presents difficulties not experienced with the usual sections. It has been clai ned that the proposed section will not be a success, on account of the wear increasing the gauge of the road.

In view of the formal transfer of the Shoenberger Steel Co.'s plant at Pittsburg to the American Steel & Wire Co., new officers have been elected as follows: Wallace H. Rowe, president; J. Ramsey Speer, first vice-president and superintendent; Klaus J. Steiner, second vice-president, Jos. McK. Speer, treasurer and sales agent; and W. L Hirsch, secretary. The following board of directors was elected J. Ramsey Speer, Klaus J. Steiner, Jos, McK. Speer, Wallace H. Rowe, and C. L. Miller. C. L. Fitzhugh, formerly president; J. Z. Speer, first vice-president; G. A Steiner, second vice-president of the Schoenberger Steel Co., retire from active connection with the business. Such retirements are unfortunately too numerous in the iron trade of late. All three have been most favorably known in the business.

The Shiffler Bridge Co. expects to have the fitting shop of its new plant at West Homestead erected by July.

The Carnegie Steel Co. in 1898 produced 2,063,466 gross tons of pig iron, ferro-manganese and other furnace products; 2,171 225 gross tons of steel ingots, which were manufactured into the finished product in the mills of the company. In additon to the above, finished castings to the amount of 55,154 were turned out by the different plants of the company.

Jones & Laughlins, Ltd., are reported to have closed deals for coal lands by which they now have 5,000 acres of coal property at Coal Center and California, which are up the Monongahela River.

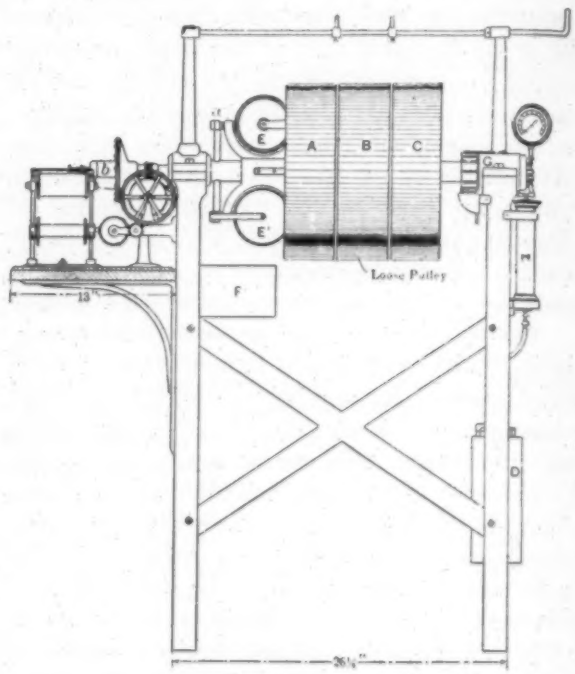
The puddlers at Brown's Tenth st. mill, Pittsburg, have been notified that their wages will be increased 25 cents a ton. This will make the rate for puddling $4.50.

POWER CONSUMED BY SHAFTING AND BELTS.

BY C. H. BENJAMIN, CLEVELAND.

In a paper published by the writer some two years ago it was shown that the average loss of power due to the friction of shafting and belts exceeded 50 per cent of the whole power consumed, in the case of some 16 different machine shops in Cleveland. The experiments made at that time simply showed the total shafting losses by means of indicator cards taken from the engines, without determining the distribution of these losses among the various elements of the transmitting machinery. In order to analyze these losses in a small machine shop, a series of experiments were made last year under the direction of the writer, by Messrs. Petch and Tenney, senior students of Case School of Applied Science.

The shafting selected for this purpose was that used to drive the machine shop at the mechanical laboratory. It consists in brief of about 90 feet of turned iron shafting, 1 15-16-inch in diameter, supported at intervals of about 8 feet by ball and socket drop hangers, made by the Walker Co. The shafting runs at a speed of 200 revolutions a minute and is oiled by wicks and oil wells. Thirty belts of an average width of 2½ inches run from pulleys on this shaft to the coun-



FIF. 1.

ter shafts of the various machines. The machinery driven by the shafting consists of lathes, shapers, etc., as indicated

TABLE I.

No.	Kind of Machine.	Size.	H. P.
1	B. & S Milling Machine..	No. 1	.183
2	Prentice Lathe	14 Inch.	.366
3	Reed Lathe	14 "	.366
4	Flather Lathe	14 "	.366
5	Reed Lathe	14 "	.366
6	Blaisdell Lathe	14 "	.550
7	Putnam Lathe	16 "	.275
8	Pratt & Whitney	14 "	.640
9	Hendey Lathe	14 "	.640
10	Flather Lathe	22 "	.275
11	Watchmakers' Lathe	7 "	.....
12	Gray Planer	24 x 24	1.920
13	Lodge & Davis shaper	15 Inch.	.550
14	Hendey Shaper	15 "	.550
15	Prentice Drill Press	25 "	.550
16	Davis Drill Press	20 "	.091

in Table I, in all a fair representation of the outfit of the ordinary small machine shop. In measuring the power consumed under various conditions, use was made of the Flather recording dynamometer. This machine is shown clearly in Fig. 1 and a detailed description of its construction may be found in *Machinery*, of August, 1898.

It is sufficient for our present purpose to say that the power is transmitted from the driving pulley A of the dynamometer to its shaft by means of pistons E working in cylinders containing oil and that the pressure of this oil is transmitted through the hollow shaft to a gauge H at one end of the machine and to an indicator pencil b at the other end.

The indicator pencil will thus draw a line on a continuously moving strip of paper, and record the amount of work done by the machine. If the dynamometer is interposed between the source of power and the work to be measured, a continuous record will be obtained showing all the fluctuations in energy exerted, and the total h. p. The dynamometer was calibrated after the tests by taking off the belt running from the pulley C to the shafting tested and connecting it to the pulley of a brake. The dynamometer was thus tested under the same conditions as those which obtained during the shafting experiments. A calibration curve was plotted from the results of these tests and this curve used in calculating the power consumed in each experiment. Experiments on the dynamometer at varying speeds showed no appreciable movement of the pencil from this cause.

Friction of the Line Shaft.

The first experiment was made on the shafting in its ordinary condition, without special oiling or lining up. Oil is usually put into the shafting boxes once a month while the counter shafts are oiled once a week. The line shafting had not been oiled for three weeks when this experiment was made, but the wick oilers were in good order and the alignmentwas correct.

The horse power of shafting, belts, and loose pulleys, was 2.78, shown by the first horizontal line on the upper diagram. (Fig. 2). The diagram reads from left to right. The sharp vertical points show the friction and inertia at starting. The belts were then removed from the pulleys and hung up so as to clear the shaft. The h. p. of the shaft alone was found to be 0.92, leaving 1.86 h p. for friction of belts and loose pulleys. The friction of the line shaft was thus about a third of the whole.

The shaft was again started and run continuously while the bearings were successively flooded with a rather light machine oil. In fifteen minutes the h. p. was reduced from .92 to .18, or about 80 per cent. This is clearly shown by the slanting line on the diagram.

On replacing the belts the total h. p. was found to be 2.04, or 0.74 less than at first. It is thus seen that the saving in power due to profuse oiling was just the same for the loaded as for the unloaded shaft, or about three fourths of a h. p. A test of the same shaft two weeks later, with the belts off, showed .26 h. p. and with the belts on 1.86 h. p. Flooding the bearings with a heavy engine oil made no appreciable difference.

Friction and Useful Work.

Several tests were made with the machines running on ordinary working days, nearly all the machines being in use but not all at one time. Table 2 shows the amount of power consumed in useful and lost work. The friction of the shafting

TABLE 2.

Date.	Feb. 24.	Feb. 23.
Duration of Test	3 h. 20 m.	2 h. 30 m.
Av. H. P., total	4.08	5.00
Av. H. P., shafting	2.78	2.78
Av. H. P., work	1.30	2.22
Max. H. P.	... ..	10.50

and belts thus consumes more than one-half of the total power used, when the machines are run under ordinary conditions. These tests probably show such conditions as would exist in any small machine shop when not crowded with work.

Tests of Separate Machines.

Several experiments were made to determine the power required to drive the different machines either idle or cutting. For a more complete description of these experiments reference is made to an article in *Machinery* for March, 1899.

In an experiment made March 11, 1898, the machines were thrown on one at a time (running idle) until all the machines were on. This is shown in the lower diagram of Fig. 2, the lower stepped line being the one referred to. The numbers below the base line in this diagram refer to the numbers of the machines as given in Table I. The horizontal line at the extreme left shows the friction of shafting and belts.

The machines were then all thrown off and again thrown

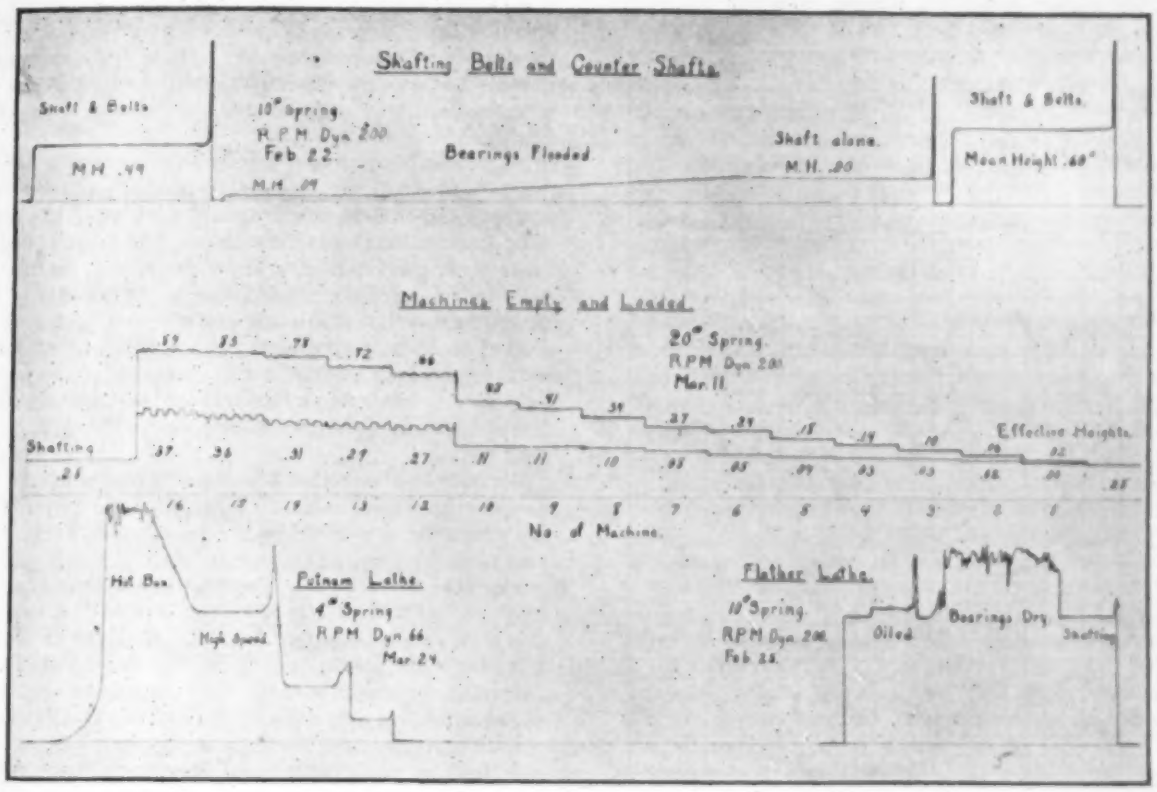


FIG. 2.

The horse power of shafting, belts, and loose pulleys, was 2.78, shown by the first horizontal line on the upper diagram. (Fig. 2). The diagram reads from left to right. The sharp vertical points show the friction and inertia at starting. The belts were then removed from the pulleys and hung up so as to clear the shaft. The h. p. of the shaft alone was found to be 0.92, leaving 1.86 h p. for friction of belts and loose pulleys. The friction of the line shaft was thus about a third of the whole.

The shaft was again started and run continuously while the bearings were successively flooded with a rather light machine oil. In fifteen minutes the h. p. was reduced from .92 to .18, or about 80 per cent. This is clearly shown by the slanting line on the diagram.

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Friction and Useful Work.

Several tests were made with the machines running on ordinary working days, nearly all the machines being in use in one at a time, but in this case cutting metal to a fair working capacity. This experiment is shown by the upper stepped line on the diagram. A comparison of the areas under the upper and lower stepped lines shows the relation of total work to lost work. Table 3 shows the percentage of

TABLE 3.

Work.	H. P	Per Cent.
Cutting Metal	4.41	43
Empty Machines	3.26	32
Shafting and Belts	2.57	25
	10.27	100

power consumed by work, by empty machines and by shafting and belts when all the machines were running at full capacity. In Table I are given the h. p.'s consumed by the different machines in removing metal.

Experiments were also made on separate machines by belting from the dynamometer to the countershaft of the machine. There is not space here to describe these experiments or to show the interesting diagrams which were obtained from lathes, planers and shapers. The power consumed by any machine depends very much on its condition and on the keenness and cutting angle of the tools used. Under ordinary circumtances the power uesd in running a planing machine is mostly consumed in moving the platen to and fro. The work of carrying the platen back after a cut is sometimes greater than the whole work of the forward stroke.

The two lower diagrams in Fig. 2 show the effect of a dry spindle on the power consumed by an engine lathe, and are self-explanatory.

THE MANUFACTURE OF CAR WHEELS.*

BY G. R. HENDERSON, SCHENECTADY, N. Y.

Like other branches of mechanical industry, the manufacture of chilled iron car wheels has been a gradually progressing science. Fifteen years ago it was customary to purchase and supply wheels to railroads on a mileage guarantee, the only restrictions as to quality being the depth of chill, and the size, shape, and weight of the wheel. Certain mixtures were used by the founder which were known by experience to produce a given chill, and this and the color of the fracture, with perhaps the mileage records, were his guides in continuing his work. Chemical analyses of the pig iron and the finished output were considered unnecessary, if at all contemplated, and the irons, both coke and charcoal, were bought by fracture and chill. Some founders used a certain percentage of steel scrap, but this never became, as far as the writer knows, common practice.

Now all this is changed; the progressive wheel-maker buys his irons on specifications, and checks them by chemical analysis, and every heat is tested physically and chemically. Records are kept of the strength and resilience of the various irons on the market, and of the manner in which his wheels

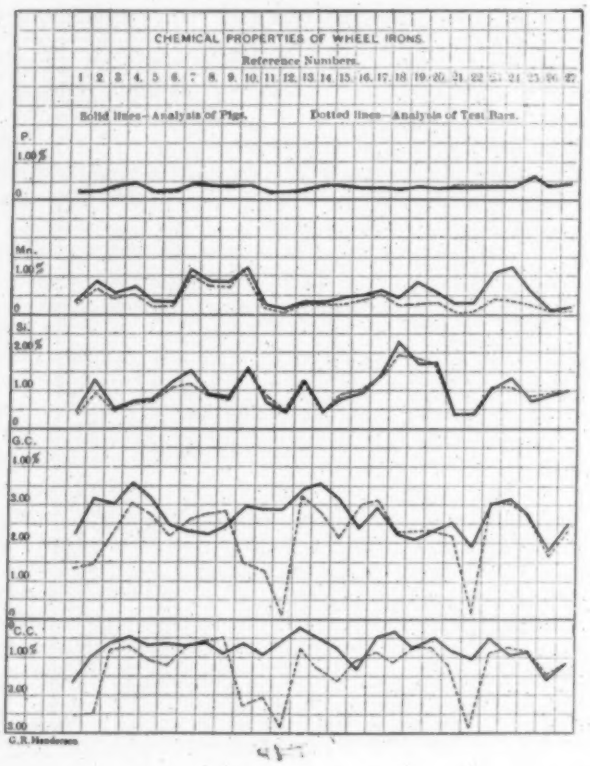


FIG. I.

fail, and as many as possible of these are examined in order to avoid duplicating unsatisfactory products.

The actual shape of the wheel has undergone little change from the original Washburn section, except in the matter of size and weight, but we have every reason to believe that the older wheels cannot be compared with modern wheels in strength or endurance. A seeming inconsistency may be occasioned by a long life of old wheels, but it must be remembered that no such weight was then carried as is now the practice, where every effort is made in the interest of economical train movement.

Having been requested to speak on this subject, I will therefore endeavor to present some points about the manufacture of wheels which have come under my observation and which may at least lead to a discussion of this interesting question, to the mutual benefit of the members and writer.

About the time when the drop test was first introduced, the writer was assistant superintendent of a railroad shop which contained a foundry making 100 wheels per day. The introduction of this test, and the failure of a number of wheels in service about that time, caused him to make efforts to secure a stronger casting. Each day test bars were made along with the wheels, and these were subjected to transverse test, and a graphical record kept of the same. The bars for this purpose were 2 inches square by 24 inches long, and were placed on supports 21⅓ inches apart, and a center load applied. As one-half of the bars were chilled, it was considered that a 2-inch bar was a proper size to illustrate the chilling qualities, without becoming white through and through, and the span was fixed at 21⅓ inches, so that when the proper deductions were made for the span and modulus of section, the corresponding direct stress was exactly four times the center load, thus facilitating the preparation of the form for recording the tests. The bars of wheel iron so tested should stand a center load of from 12,000 to 14,000 pounds before breaking, this corresponding to a maximum fibre strain of 48,000 to 56,000 pounds per square inch. The deflection at the moment of breaking is also of great importance, and there are wide differences between various irons in this respect. While the strength of the metal indicates a power to stand pressure, we need the resilience to withstand shocks.

This same treatment has been accorded to unmixed pig iron of the various grades suitable for wheel founding, the pig being melted separately in a small experimental cupola, and from these records the wheel founder makes his selections. The curves in a graphic record present to the eye a meaning easier to grasp than mere figures, and when bound together in a book comparisons can be quickly and accurately made. The amount of chill and shrinkage are also noted, together with the color of the fracture and the chemical analysis of the iron.

As the composition of different shipments of iron from the same furnace will vary greatly, it naturally follows that the strength and chilling properties are not always the same. It happened not long ago that a certain iron, which had previously given good results, became almost unfit for use, principally by reason of a great decrease in the amount of manganese. At one time this would probably not have been considered of such vital importance, but the fact has recently been well established that a certain amount of manganese is necessary in order that a wheel shall successfully stand the thermal test; it also seems to increase its strength under the drop test.

We have now seen that the wheel founder of the present day has the results of chemical analysis and physical tests of the unmixed iron and also of the mixture, as well as the results of the drop and thermal tests, to guide him in his work. The tests of today's heat are carefully studied by him in order that any defects may be corrected tomorrow. For this reason it is important that the analysis and deflection test should be placed in his hands early. The drop and thermal tests cannot be made until the wheels are taken out of the annealing pits, a period of from five to eight days.

But this is not all. These tests are intended to show us quickly what kind of service we may expect from our wheels, when under the cars, and the records of the life and failure of wheels in service are of the utmost importance. The actual mileage of a wheel under a freight car is a difficult thing to obtain, that is, it requires considerable labor, especially when the number of wheels in use runs up into the hundred thousands. For this reason the life of wheels is often kept by months; and while this does not take into consideration the time spent in the repair yard or on the side track, it has the advantage of being very easily obtained.

As new wheels are made, the foreman of the foundry makes a daily report, giving the wheel numbers and the mixture used. The former are entered in a book which contains the serial wheel numbers, and the latter are entered in another book which later has the result of the drop and thermal tests recorded, as well as the depth of chill, shrinkage, etc. When the wheels are mounted on the axles a report is made weekly of the numbers and place at which this work was done, and this is entered in the book with serial numbers. Each week a report is also made from each point at which wheels are scrapped, giving the number and the cause; and when these are also entered, we have a complete record of dates ad places of the "birth, marriage, and death" of each wheel.

This record is a most interesting one, as it gives the service which the wheels perform. [Samples of the several forms referred to, both for making the reports and recording the information, were presented in connection with the paper.]

In looking over such a record it is at once apparent that a

* Read at the Washington meeting (May 1899) of the American Society of Mechanical Engineers.

large number of wheels are always damaged by improper handling or usage. The proportion of slid-flat wheels has been very large heretofore; we hope that the more general use of air brakes will effect an improvement in this line. Chipped flanges and worn flanges are also not generally chargeable to the wheels themselves.

What most interest the founder are those which are scrapped for cracked plates, cracked brackets, and broken-to-pieces, as these show improper manufacture in the majority of cases. As the Master Car Builders regular guarantee is for forty-eight months, all wheels which run over five years may be considered as giving good service; and if these wheels can be obtained, the study of their analysis is very beneficial. Therefore, wheels giving a very short service or a very long one should be carefully inspected and analyzed, as they will show the bad and good features in a much more forcible way than drop or thermal tests. Mr. W. W. Davis, chemist of the Norfolk & Western Railway, who with the writer has given much attention to this subject, analyzed a large number of wheels giving a long or short service or tested by the

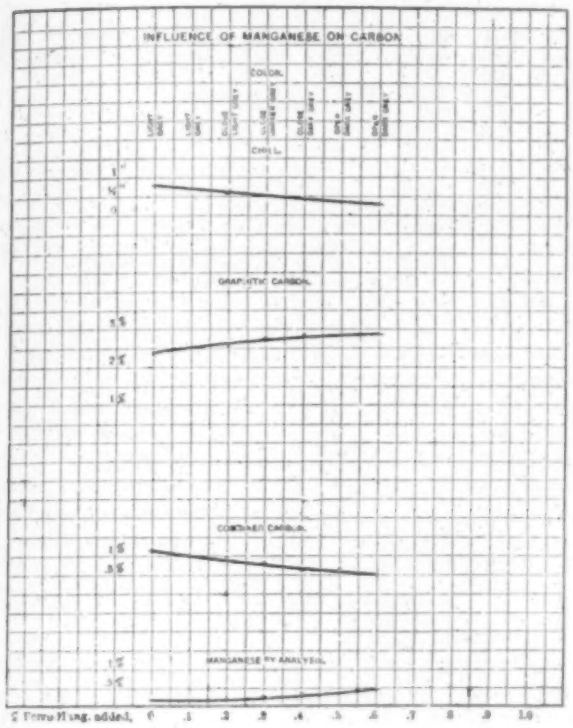


FIG. 2.

drop or thermal methods, and we present the results of some of his work:

	Analyses of Car Wheels.					
	Which Stood Thermometer Test for 60 Minutes		Which Stood 40 or More Blows Drop Test.		Which gave 5 or More Years of Service.	
	Max.	Min.	Max	Min.	Max.	Min.
Graphite	3.28	2.65	3.31	2.65	3.18	2.23
Combined carbon	.95	.32	.90	.55	1.24	.56
Si icon	.75	.50	.70	.50	.94	.58
Manganese	.53	.20	.46	.24	.34	.13
Sulphur	.088	.055	.086	.040	.085	.047
Phosphorus	.48	.35	.52	.36	.49	.25

It will be seen that these limits are rather wide, but below are given what are considered to be the desirable limits for the chemical constituents of wheels:

DESIRABLE WHEEL ANALYSIS.

Graphite	2.75 per cent to 3.00 per cent.
Combined carbon	.50 " " .75 "
Silicon	.50 " " .70 "
Manganese	.30 " " .50 "
Sulphur	.05 " " .07 "
Phosphorous	.35 " " .45 "

By comparing the above with the analyses of a large number of wheels it was found that these limits excluded those which broke through rim in ten minutes or less under the thermal test; broke with twenty blows or less under the drop test; or gave less than two years' service. This last is important, as a wheel can easily be made to stand strains, but the wear will be unsatisfactory, and the metal must have enough chill to stand the abrasion of the track. It is possible to obtain a chill three-quarters of an inch deep on the tread with these proportions.

The analyses of seven wheels which had given from eight to 11 years service each had the following limits:

Graphite	2.56 per cent to 3.10 per cent.
Combined carbon	.63 " " 1.01 "
Silicon	.58 " " .68 "
Manganese	.15 " " .27 "
Sulphur	.05 " " .08 "
Phosphorous	.35 " " .45 "

Fig. 1 shows the comparisons between chemical analyses of pig iron and of the test bar made by remelting the pig in a cupola by itself. Twenty-seven different irons were examined in this way. The solid line represents the analysis of the pig and the broken line that of the test bar. It will be seen that phosphorus remains constant, as does silicon when present in quantities under one per cent, whereas some of the manganese always disappears. The total carbon remains the same, but the proportions of graphitic and combined carbon seem to vary in an erratic manner. This is evidently due to the effect of the chill, as the analyses were made from the chilled test bars when possible, and the great increase in combined carbon in tests Nos. 11, 12, and 22 may be accounted for by the fact that they chilled clear through the two inches.

From the above it will appear that the metal charged into the cupola should contain more graphite, silicon and manganese and less combined carbon than are desired in the finished product. If the iron in stock is deficient in manganese, the proper amount can easily be added to the mixture in the ladle by the use of ferro-manganese containing about 80 per cent manganese 13 per cent iron and 6 per cent carbon (combined). The use of large proportions of scrap makes this particularly useful, and it is of great assistance in enabling the wheel to stand the thermal test and consequently the strains from severe braking when in service.

Indeed, cracked plates are almost a thing of the past with foundries keeping the manganese up to the limits prescribed above, where previously much trouble was due to that cause. To overcome this it appears that one-quarter of one per cent should be present in the wheel. Ferro-manganese, however, seems to reduce the chill by increasing the graphitic carbon, as Fig. 3 will show, and this must be allowed for in proportioning the charge for the cupola. The combined carbon is partly changed to graphite, but not entirely in proportion to the amount of ferro-manganese used.

The experiments from which results Fig. 3 was constructed were made by filling small ladles containing different proportions of ferro-manganese from a large ladle which had been filled with the regular wheel mixture, and casting test bars from these small ladles. The effect of this is plainly illustrated both in altering the structure of the iron and the condition of the carbon content.

In preparing specifications for charcoal irons the difficulty of obtaining limits which should be perfectly satisfactory was not underestimated. It is therefore hoped that these will be criticised more as representing an effort to compass a complicated subject than as an absolute specification which has stood the test of time.

Charcoal Pig Iron.

"The material desired under this specification is a charcoal iron with chilling properties as designated below, the various grades to conform to the detail specifications:

Grade.	Chill.	G. C.	C. C.	Si.	Mn.	S.	P.
2	¼ inch	2.50-3.00	.40- .90	1.25-1.75	.50-1 00	.03 Max	.25-.40
3	⅜ "	2.25-2.75	.50-1.00	1.00-1.50	.50-1.00	.03 "	.25-.40
4	½ "	2.00-2.50	.75-1.25	.75-1.25	.50-1.00	.035 "	.25-.40
5	1 "	1.75-2.25	.90-1.40	.50-1.00	.25- .75	.035 "	.25-.40

"The chill is to be measured in a test bar 2 inches square by 24 inches long, the chill piece to be so placed as to form part of one side of the mold. The actual depth of white iron will be measured. The white and gray portions should blend without a definite line of demarcation. The test bars will be made by melting in a small cupola several pigs of the shipment without admixture with other irons.

"The chemical proportions given above are the amounts of the constituents desired in per cents, and will be determined by the analysis of mixed borings in equal quantities taken from 12 pigs from each car.

"In addition to the chilled test bars above mentioned, some unchilled bars of the same size will also be made.

These will be placed upon supports 21½ inches apart. A center load will be applied and the deflection measured. The bar should not break with less than 9,000 pounds, and the deflection at center with this load should not be less than 0.15 inch."

While charcoal iron is the principal ingredient in car wheels, it is often advantageous to use a small amount of coke iron, and the following specification is therefore submitted:

Coke Pig Iron.

"The material desired under this specification is an open-grain foundry pig conforming to and graded by the following detail specifications:

Grade No.	1,	Silicon from	3.00	per cent to	2.50	per cent.	
" "	2,	" "	2.50	" "	2.00	"	
" "	3,	" "	2.00	" "	1.50	"	
" "	4,	" "	1.50	" "	1.00	"	

"Iron will be rejected which shows:

Combined carbon below	.10	per cent.
Graphitic carbon below	3.00	"
Manganese below	.50 per cent or above .80	per cent.
Phosphorus below	.50	"
Sulphur above	.06	"

"Should the silicon vary from standard grading, the next lowest grade under the specifications will be paid for, and should the silicon fail two grades low the material will be rejected. No higher grade is desired and no excess price will be paid for higher silicon. Samples of 12 pigs will be taken from each car, two from the top of each end, two from the middle, and two from the bottom. The borings will be mixed in equal quantities and the resultant sample represent the shipment."

Reference having been made to the drop and thermal tests, it may be well to conclude this paper with a specification for car wheels, which will give the details of these tests for ready reference.

33-Inch Cast Iron Wheels.

"The design of wheels must be such that they will be in accordance with the measurements shown on the drawings for 33-inch wheels, and also such that the wheels when cast shall weigh between 590 and 610 pounds. The tread and flange are to be identical with the M. C. B. standard section for same, and the flange thickness must pass the M. C. B. gauges for same.

"Wheels must all be cast in true metallic chills of the same internal diameter and of uniform cross section. The body of the wheel must be of clean, soft, gray iron and smooth and free from slag and blowholes, and hubs must be solid and free from drawing. The tread and throat of wheel must be smooth, free from deep and irregular wrinkles, slag and sand-wash, and practically free from chill cracks and sweat. The depth of clear white iron must not exceed ⅜-inch at throat and 1-inch at middle of tread, nor be less than ⅜-inch at throat and ½-inch at middle of tread. Neither should there be a variation throughout the same wheel of more than ¼-inch in depth of chill. The blending of the white iron with the gray iron behind it must be without any distinct line of demarcation.

"Each wheel must be so nearly circular that when a true metallic ring is placed upon the tread, and bears somewhere on the cone, it shall at no part of the circumference stand more than 1-16-inch from the wheel tread. No wheel made in a solid chill will be accepted whose circumference differs more than 1⅝ inches, or less than ⅞-inch from the circumference of the chill in which it is made. Wheels cast in contracting chills should not differ in circumference more than 2 inches from that of the chill.

"All wheels must, during inspection, receive three heavy blows with a 6-pound sledge at as many different points under the flange, between the brackets, without cracking flange or brackets. Each wheel must also be capable of standing a pressure of 50 tons when being mounted on the axle.

"For each pouring of 100 wheels, or fraction thereof, two additional wheels must be furnished for test purposes.

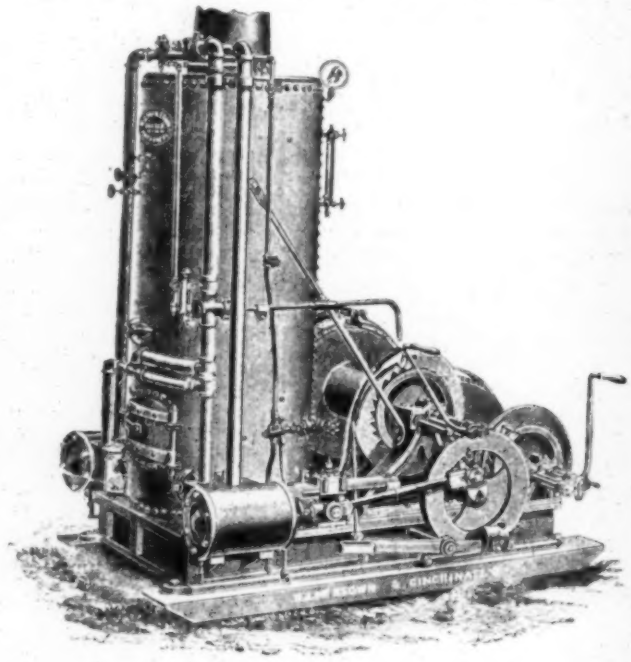
These wheels shall be selected by the inspector, and subjected to the following test: One wheel shall be placed flange downward on an anvil block weighing not less than 1,700 pounds, set on rubble masonry two feet deep, and having three supports not more than 5 inches wide for the flange of wheel to rest upon; it shall be struck centrally upon the hub by a weight of 140 pounds falling from a height of 12 feet. Should this wheel stand 15 blows without breaking in two or more pieces, the lot of 100 may be accepted (as far as this test is concerned), provided that the broken wheel shows proper depth and uniformity of chill; also subject to return if the wheels do not satisfactorily stand boring and mounting, as explained above. Should the wheel break in two or more pieces with 15 or less blows, the lot of wheels represented by the one tested will be rejected.

"The other test wheel must be laid flange down in the sand, and a channelway, 1½ inches wide and 4 inches deep, must be molded with green sand around the wheel. The clean tread of the wheel must form one side of this channelway, and the clean flange must form as much of the bottom as its width will cover. The channelway must then be filled to the top with molten cast iron, which must be hot enough when poured so that the ring which is formed when the metal is cold shall be solid or free from wrinkles or layers. The time when pouring ceases must be noted, and two minutes later an examination of the wheel must be made.

"If the wheel is found broken in pieces, or if any crack in the plate extends through the tread, the 100 wheels represented by the test will be rejected. Wheels may be dried before submitting them to the thermal test, but must not be warmer than 100 degrees Fah."

M'KEOWN FRICTION ENGINE.

The McKeown double drum hoisting engine is manufactured by the patentee, H. J. McKeown, 612 E. Front st., Cincinnati. It is of the plain side valve type, with piston rod, valve rods and slides of steel. The cross-head has gun metal gib with two adjusting screws to take up wear. The piston head is of cast iron, with spring rings fitted to be steam tight until worn out. The connecting rods are of Swedish iron. The ends are solid and fitted with brass boxes with one key in each end to take up wear, which is an improvement over the common strap joint with gib and key. Large crank plates are used and care is taken to provide proper balance to counteract the weight of all reciprocating parts. Friction is of the cone type. The segments are of seasoned hard timber, with the end of the wood to the wearing surface, bolted with a circular wrought iron ring on the inside, which forms the nuts for the bolts that are through the spur gear. The drum



is loose on the shaft until brought in contact with the wood bolted to the gear, by a lever. There are provided double thread screw, steel pin and gib, under the control of the engineer, who can hoist or lower at will. There is also a tight winch-head on each drum shaft, with ratchet and pawls on each drum. The boiler is of plain vertical tubular type, with 2-inch flues. The shell is of sheet steel, vertical seam, double riveted, 60,000 pounds tensile strength and tested at 175 pounds hydraulic pressure, calculated for 100 pounds of steam pressure. A wrought iron hood is used, to give the boiler all the advantage of natural draught. The makers test all their engines and boilers with steam at 100 pounds pressure.

THREE-SPINDLE HIGH SPEED DRILL.

The Fox Machine Co., of Grand Rapids, Mich., developed its high speed drills originally for its own use, incorporating in them features which it did not find in the machines in general use. These drills are made with one, two, three, four and five spindles, a three-spindle drill being shown in the

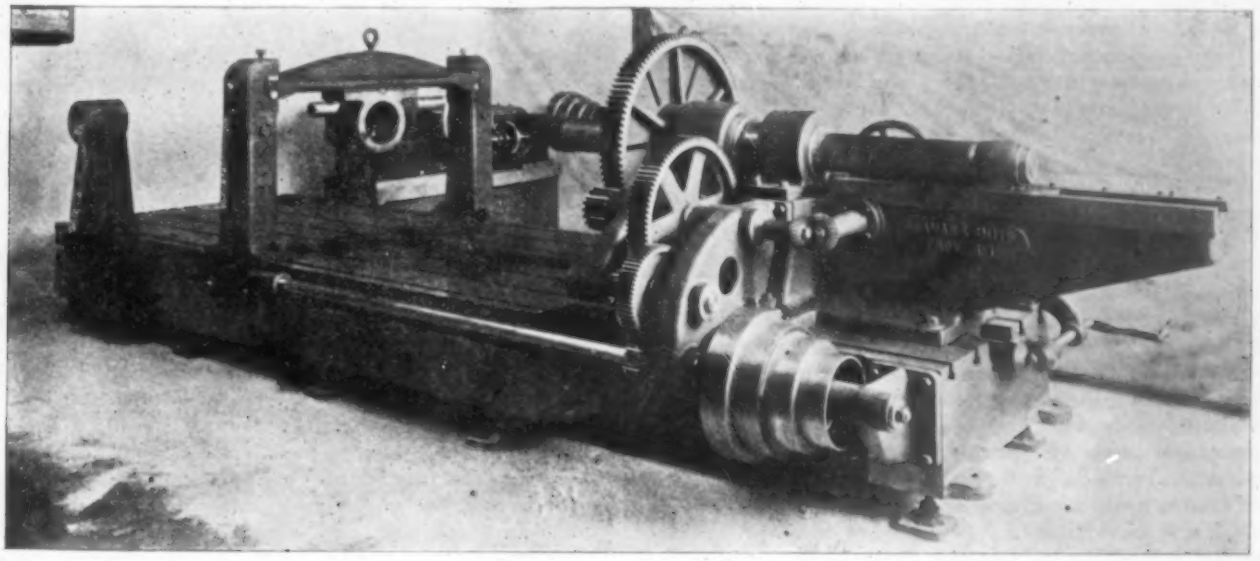
accompanying cut. The features of all the Fox high speed drills are their removable bushings of unusually long bearing, renewable at small expense, the provision of three changes of speed for each spindle independently and the counterbalancing of the spindles by quick-acting springs. In the design, regard has been had to a proper distribution of metal. The spindle bracket has quick adjustment on the column, and eccentric clamping levers hold the table firmly, giving quick adjustment. The table is counterbalanced in the column. On adjustment of the tables, the length of the column is possible, to take in large and irregular jigs. There is an adjustable collar on the top of each spindle to gauge the depth of holes. The swing on the main column is 13¼ inches; on the top bracket 16½ inches, and the table adjustment is 22 inches. The vertical adjustment of the spindle bracket is 10 inches and the vertical motion of the spindle, 4¾ inches. From center to center of spindles on multiple drills the distance is 7 inches. The weight of the three-spindle drill shown is 550 pounds. The tight and loose pulleys are 8x2 inches, and the machines are run effectively at 300 revolutions.

ENGINE FRAME BORING AND FACING MACHINE.

At present a large quantity of machinery in which are represented nearly if not quite all lines is being exported. These exports are due not only to excellent design and workmanship, but also, in some measure, to the favorable prices at which American machinery is being offered. That our manufacturers can so compete, with the low per diem cost of foreign labor, is due to the use of methods and appliances which enable the workman here to produce more in a given time than his competitor abroad. An illustration of appliances to lessen the cost of production is found in the machine herewith shown, which has recently been put into service and is giving satisfactory results.

It is essentially a special and manufacturing tool and is used for the purpose of facing that portion of a stationary engine frame, or bed, to which the cylinder is attached, boring the circular portion for the cross head guide, and also for the crank shaft bearings. All three cuts are taken simultaneously, consequently there is not only a saving in time required actually to take the cuts, but the piece is set and fastened at once, which is another saving. Further, as the alignment of the work is accurate, there is another saving when the parts are assembled.

The machine consists of a large platen on which an adjustable head is fitted, and provided with sufficient horizontal movement to receive frames of the largest and smallest size for which the machine is intended. The head carries a spindle, which is strongly driven, and used to bore the guides for the cross head, while the large driving gear carries a facer which finishes the end of the frame to receive the cylinder. At right angles to the head and spindle referred to is another head, mounted on a suitable bed and attached to the side of the platen. It carries a spindle which is used to bore the crank shaft bearings, and do such facing as may be required. Variable automatic feeds are provided as required, as well as outer supports for boring bars. As a whole, the machine is



conveniently handled, although a strong, substantial and heavy one, weighing about 33,500 pounds. It was designed and constructed by Beaman & Smith, Providence, R. I.

The American Car & Foundry Co. has declared its first quarterly dividend of 1¾ per cent. The following figures indicate the work on hand: Freight cars, 15,245; passenger cars, 48; car wheels, 176,193; castings, 17,743 tons; bar iron, 18,000 tons; axles, 3,600 tons; cast iron pipe, 1,600 tons.

THE DECEPTIVE FRACTURE OF PIG IRON.*

BY THOS. D. WEST.

Progressive furnacemen and foundrymen have experienced few changes in their practice that have been more radical in character or far-reaching in benefit than those made by the adoption of chemical analysis to correctly define the grade of pig iron. The change was such a common-sense one that many are annoyed to think that in this age of science they had not always utilized chemistry in their practice. When we think back to the time that all furnacemen and founders were guided wholly by the appearance of fractures, instead of knowing the chemical analysis of their pig iron, we naturally have a right to wonder how we ever succeeded in business, and not until we bring to mind the old-time prices paid for castings, can we realize why commercial success was at all possible to many following the old school methods of judging the grade of pig iron.

While the benefits obtained by adopting chemical analysis in foundry practice are generally very great, the advance has been slow. This is on account of the prejudice, selfishness and conservatism that all new departures in any calling must meet and set aside. The opposition that existed, and is yet in force to-day, against the adoption of grading by chemical analysis, is best known to its leading advocates. The fact that many founders still adhere to the old-school practice of judging pig iron by its fracture, causes some to suffer losses or meet difficulties that would not exist did all founders understand the utility and value of chemical analysis in defining the grade of iron, and follow its dictation in their practice. It is often interesting to investigate the grounds for rejecting the new-school practice that members of the old set up against its advocates. Not long ago, as an example, in discussing the merits of working by chemical analysis with an old experienced founder, who had never mixed his metals by this method, he expressed the belief that if a cast of nice open-grained pig iron did not give a softer iron than a close grained pig mixture, it was because of some local condition not being controlled; as, for example, he claimed that the cupola might not have been daubed properly, or the bed not well lighted before the iron was charged, or the charge might not have been placed evenly, or that the stock hung up. Then, again, he claimed that it might be due to other conditions, such as to be found in bad scrap iron, changeable weather, difference in fuel, fluxes, or variable blast pressures, to cause fast or slow melting, etc. When, as practical foundrymen, we know that such varying conditions may at all times affect mixtures, and cause a soft iron to be hard, we are forced to confess that the old-school fellows may go along for years, if they are in any way prejudiced against the new-school practice, before events may transpire to convince them that by following chemical analysis they will greatly decrease their mishaps for the simple reason that if an open cast of pig metal does happen to give them a hard iron, they have nearly a dozen evils or excuses to which they can charge their poor results. A study of this phase of the subject should explain why some are slow to accept chemical analysis in selecting and mixing their pig irons, and also that whenever it suits the self-interest of any to prejudice the utility of chemistry in the mind of the old-school founder, they can easily do so by taking advantage of their prejudice and want of knowledge which the new school possesses.

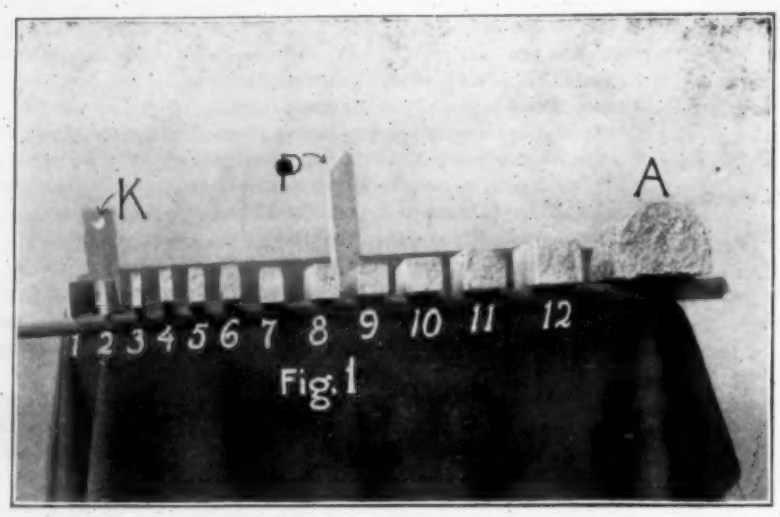


Fig. 1

There are several ways in which self-interest can retard the progress of chemical analysis in founding. As an example, we will cite two cases. The first lies in the power of furnacemen knowing the utility of chemical analysis and lack of that knowledge by the old-school foundrymen. To illustrate how the latter may be duped by making them think their practice correct: A well-known firm, standing high in its ability to cast heavy machinery, recently sent an order to a furnaceman for one car of a strictly all open-grade iron to make strong castings for a special job. The writer was consulted as to the analysis necessary, as the furnaceman knew he could select the open iron in almost any grade. Upon learning the character of the casting required for the furnaceman, the writer recommended silicon between 1.00 and 1.25 with sulphur about .030. A car of as beautiful open-grained coke iron as was ever seen was sent to the founder. Its results pleased him so much that in a short time the second order, "Send me another car of strictly No. 1 iron, same as last," came in. The furnaceman, knowing the utility of chemical analysis, referred to his books, and duplicated his last analyses, being careful, of course, to load nothing but an all No. 1 open-grained iron, as, if he had sent a close-grained iron it would have been condemned. Now, this furnaceman is not going out of his way to advocate the utility of chemical analyses to that foundryman, and it would be almost useless for anyone else to attemptto do so, as that founder is stubborn in the belief that it is the open-grained iron of that peculiar brand which was wholly responsible for obtaining the results desired. Then again, should this founder, on account of a difference in price, change to another furnaceman, who might not have had the forethought to consult some expert of the new-school in regard to analyses, the chances are that his open-grained iron would have given him too weak a result in his castings; but as long as this founder had his open-grained iron, he could turn to changes in the fuel, scrap irons, blast, weather, methods of charging, etc., to make excuses for his ill results. And not until such a paper as this, exposing the true cause of his trouble, might by chance fall into his hands, is there any hope of his being made a follower of the new-school practice.

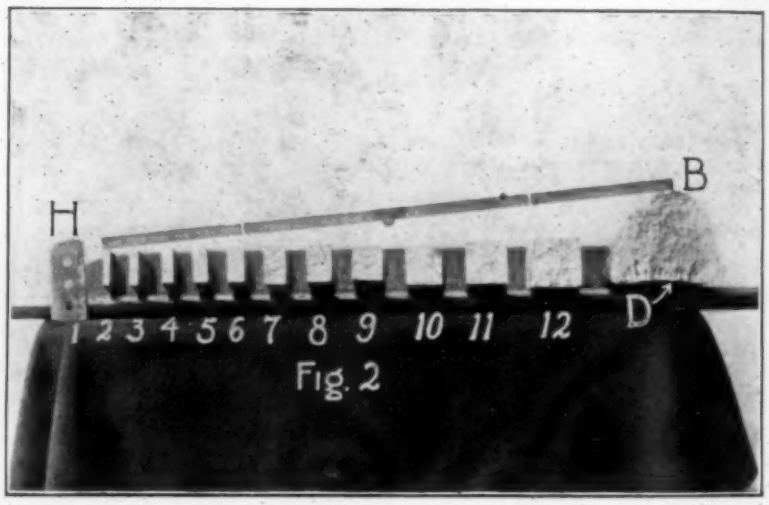


Fig. 2

The second illustration of the way in which self-interest has retarded the advance of chemical analysis is the advocacy of testing machines, as affording the founder sufficient means to regulate his mixtures, without resorting to chemical analysis. Testing machines have their place, and most founders should possess one; but the practice of taking advantage of the prejudice, etc., of the old-school methods to

* Read at the Pittsburg meeting (May, 1899) of the American Foundrymen's Association.

antagonize the advance and true utility of chemical analysis in the self-interest of a more rapid sale of testing machines, is to be deplored.

The foundation of the old-school method in regulating mixtures is based on the belief that the appearance of pig fractures truly defines the character of iron as to the degree of hardness. The founder's own experience in knowing that he can make soft and hard castings from the same ladle and at one pouring, if he choose to so construct his molds, should be sufficient to prove to him why it is possible for two furnace casts of pig metal that are alike in chemical analysis, or will give the same results when melted, to differ so widely in appearance that the fracture from the one cast will seem close-grained or hard in the pig, while the other will be the reverse. A founder can take the same ladle of iron, and by pouring part of the metal into a mold that will chill or solidify it quickly, produce a fracture that will be close-grained in the one case and open in the other. This is just what the furnaceman does in making pig iron One part of his tap, or cast of iron, may run so slowly from his furnace as to chill the metal before it reaches the pig beds, while another tap or cast may come so fast as to fill the pig beds so rapidly that it will take quite a while for the metal to solidify.

Again, one tap or cast at a furnace may give much hotter iron than another, and it is natural that the dull iron should cool faster than the hot, and, if both run at the same speed from the furnace down the long runners to the pig beds, will give the closer grained iron in the case of the duller metal. Surely the founder should perceive from this why the same kind of iron may have in one cast a close grain, and in another an open grain. As there are but few molders or founders who have ever had the opportunity of witnessing a furnace cast, this explanation of its workings, combined with their own foundry experience, should assist many to realize why the fracture of pig metal is an unreliable guide to the iron's true grade.

There are those who still contend that open fractures mean a soft iron and a close-grained iron a hard one, and if different results are obtained, to charge them to changes in fuel, scrap iron, fluxes, blast, weather, etc. The writer has selected

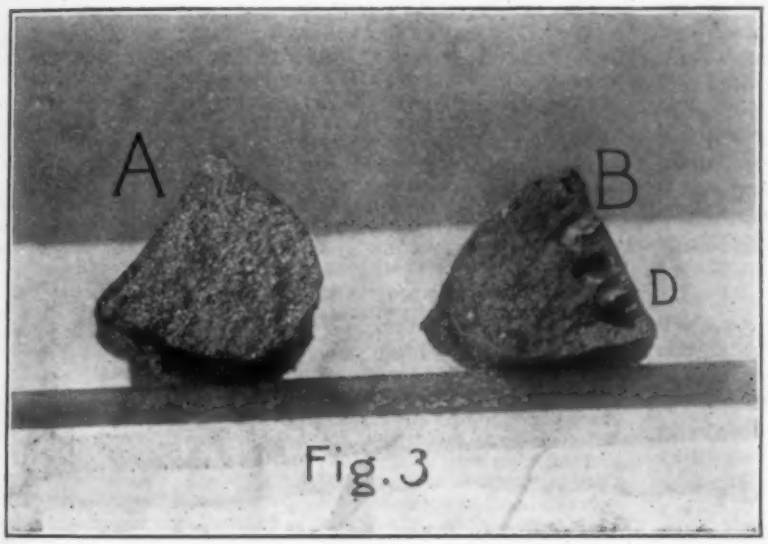


Fig. 3

samples of pig shown in Figs. 1, 2 and 3, that are a fair representation of the whole cast or car of iron. If any of the old-school founders were asked to select a cast or car of iron to give soft castings, they would pick out iron such as sample "A," seen in Figs. 1 and 3, while if they desire to make strong or hard castings, they would select such irons as are represented by sample B, seen in Figs. 2 and 3. In fact, if some were asked to use such a cast or car of iron as that represented by B, they would claim that on account of its close grain and the blow holes seen at D, the iron was hardly fit for sash weights, let alone being of any value to make soft castings.

In order to convince the skeptical, or those not conversant with chemical analysis, or the effect of one metalloid upon another, that they are in error, the writer melted down about one hundred pounds of each of the grades A and B in his twin-shaft cupola described in a paper before the Pittsburg Foundryman's Association, June 28th, 1897, and shown in the association's *Journal*, vol. 3, Nos. 13 and 14, also in *The Foundry*, Aug, 1897. In melting these irons A and B to make the castings seen in Figs. 1 and 2, and which range from one-eighth to two inches in thickness, all conditions were alike as near as it was possible to have them, so that if the open-grained iron, A, gave a hard casting, changes in fuel, scrap, blast, weather, etc.—the old excuse—could not be offered as an explanation to befog the true cause. The sample of pig used and sections of the castings made from them, the writer has brought to this meeting, so that all may see them, and all are invited to take drillings from the specimens to report whether their analyses agree with those presented in Table I, in which the letter A represents the analyses obtained from the pig and the castings seen in Fig. 1, while B gives that secured from Fig. 2.

TABLE I.

Samples		Silicon.	Sulphur.
A	Pig	1.25	.035
	Castings	1.13	.070
B	Pig	2.86	.040
	Castings	2.67	.060

The fracture seen in Fig. 3, being enlarged, will afford a better study of the difference existing between the grain of the pig, samples A and B. To the new-school founder, Table I is sufficient to define the results, or whether samples A and B would give the soft or hard iron upon being re-melted, but for the old-school of founders, Tables II and III will best serve such ends. A study of these latter tables will show them that the pig, B, which would have been condemned by those wishing to make soft castings, gave by far the least contraction and chill, so much so that the test pieces, only one-eighth inch thick, as seen at H, Fig. 2, are so soft as to be readily drilled, while that at K, Fig. 1, made from sample A, broke a drill in trying to get one hole through the thin piece one-eighth inch thick. In fact, we were foolish to try to touch it with a drill, as the metal was nearly all chilled or white in color, as can be seen in the sample brought here for your inspection. It is also to be said that all the other test pieces ranging from Nos 2 to 12 that were made from the pig, sample A, were also much harder than those made from sample B. In measuring the depth of a chill, pieces were broken off one end of the test bars, as seen at P., Fig. 1.

TABLE 2.

RECORD OF TESTS TAKEN FROM IRON SEEN IN FIG. 1.

No. of bars.	Size of bars.	Contraction.	Deflection.	Strength, Lbs.	Chill.
1	½x ½	.293	.29	110	Nearly white.
2	½x1½	.366	.25	320	¼ deep.
3	⅜x1½	.243	.31	550	¼ deep.
4	⅜x1½	.220	.18	860	3-16 deep.
5	⅜x1½	.200	.15	1,380	3-16 deep.
6	¼ x1½	.182	.14	1,600	⅛ deep.
7	⅜x1½	.165	.1	2,240	⅛ deep.
8	1x ½	.150	.10	2,900	3-32 deep.
9	1¼x1¼	.148	.08	3,640	3-32 deep.

TABLE 3.

RECORD OF TESTS TAKEN FROM IRON SEEN IN FIG. 2.

No. of bars.	Size of bars.	Contraction.	Deflection.	Strength, Lbs.	Chill.
1	½x1½	.178	.35	164	03 deep.
2	½x1½	.163	.030	344	.02 deep
3	⅜x1½	.150	.24	530	.01 deep
4	½x1½	.137	.15	920	H'dly p'rc'ble.
5	½x1½	.125	.14	1,208	No chill.
6	⅜x1½	.113	.12	1,640	No chill
7	⅜x1½	.101	.11	2,320	No chill.
8	1x1½	.92	.10	2,860	No chill.
9	1¼x1¼	.88	.10	3,500	No chill.

NOTE.—Test bars Nos. 10 to 12, seen in Figs. 1 and 2, were not tested, owing to the machine being too small to break them. This chill was obtained by causing the end of the test bars farthest from the gate to be formed by a wrought iron bar three-fourths by two inches wide. The 12 test bars were molded in green sand and poured from one gate. The same "temper" of sand was used for both flasks, and the iron was alike in fluidity at the time of pouring. It is hoped that a study of this paper will help to covnince those yet remaining aloof from utilizing chemical analyses, that the deceptive fracture of pig iron has and will continue to often mislead them in rightly locating the cause of trouble and losses in their efforts to obtain desired results from iron mixtures.

THE second annual meeting of the American section of the International Association for Testing Materials will be held in Pittsburg on Aug. 16 and 17.

MOLDING MACHINES FOR STOVE PLATES.*

BY ABRAM C. MOTT, PHILADELPHIA.

Your president has requested that I should read a paper on the subject of molding machines and their adaptability to the stove trade. Now this, in no wise, can be called an address, but is simply a compilation of a few facts. In the first place —what are molding machines? This can be answered by saying that they can be classed under several different heads.

First, there is a molding machine which is known as the "squeezer." After the operator has filled the flask with sand, he presses the sand into position. This is generally done by a side lever (which is operated by the workman). All other operations in molding being performed in the same usual way as heretofore, therefore the name "squeezer.". It is simply the pressing or ramming of the sand into the mold.

Under the second head, we might possibly class the machine as a draw or stripping-plate machine, which, by the movement of a lever, drops the patterns from the mold, these being rammed in the usual way by hand. This machine accomplishes but one thing, which is the drawing of the patterns.

Under the third head we might class the machine as one which combines the "squeezer" and the "draw plate,"and the operation of this machine is to squeeze or ram the mold and draw the patterns. This ramming is done, either by the operator using the lever, as in the squeezer, or by power.

Under the fourth head there is a machine which has recently been placed upon the market and is known as the "vibrator." This is usually combined with power for ramming (said power being used in the form of compressed air), thus almost instantaneously ramming the mold. The patterns are withdrawn by the movement of a lever with the right hand, and, at the same time, the operator presses a compression cock with the left hand, bringing a small hammer into play, which vibrates the pattern as it is drawn from the mold, and the operation is as follows: The ramming head is thrown back, leaving the top of the machine clear; a flask is placed on the same and filled with sand, a 3-way cock attached to the machine is quickly operated, admitting compressed air of 70 to 80 pounds pressure to the inverted cylinder, the head having first been drawn into place. The cylinder, with the entire upper portion of the machine, is thus driven forcibly up against the ramming head, flask, sand and all. Often a single blow suffices to ram the mold; often the blow is quickly repeated, according to the demands of the particular mold in hand. Gravity returns the machine to its original position, as the 3-way cock opens to exhaust. After pushing the ramming head back, and cutting sprue, if the half mold is a cope, the operator seizes the lever, and drawing it forward and down, raises the outer frame of the top of the machine containing the flask pins, with flask and sand thereon, away from the patterns, thus drawing the pattern from the sand. The operation on the drag is the same, but (as you will readily perceive), you must have two machines, and a pattern for both cope and drag. Just as he seizes the pattern-drawing lever with his right hand, he presses with his left on the head of the compression valve, thus admitting air to the pneumatic vibrator already referred to. This consists simply of a double-acting, elongated piston, having a stroke of about 5-16 of an inch, in a valveless cylinder, and impacting upon hardened anvils, at either end, at the estimated rate of 5,000 blows per minute, like the well-known chipping or calking hammer. This vibrator does not really rap the patterns, it simply puts them in the condition of "shiver," relieving all tendency of the sand to adhere to the patterns, thus allowing intricate carving in the center of the mold to be drawn as readily as the outside portion.

Having thus briefly described the different forms of molding machines, we have to consider their advisability as to stove plate molding.

In the first place, the majority of these machines are intended for snap work, or molds which are usually made in snap flasks, and for these, where there is great enough multiplication, there is no doubt as regards to the utility and usefulness of either of them, but stove plate molding presents difficulties in the way of their general usefulness. The great majority being made in bound or wooden flasks, specially formed and barred for the patterns which they are designed to mold, and these are made in very small quantities. None of the machines that ram the mold (either by leverage or power), are designed to ram a barred flask. There are, however, certain articles, very few in number, namely, legs, covers, cross-pieces, and certain grates, which may be made to advantage on these machines. But by taking either of these forms of machines, the draw-plate for instance, such an expense is required to make it, and such care-taking of it afterwards, that, unless there could be made at least 60 full days' work throughout the year, from one pattern, the saving would hardly pay for the expense of the draw-plate.

In all of the articles mentioned, or any others which I know of in stove plate molding, it would require a pattern and a draw-plate, both for the cope and the drag of the mold; and the usual operation would be that one operator would make the drag on one machine, and another operator would make the cope on the other machine, placing the two together on the floor. In the making of these draw-plates, the utmost care must be exercised; in fact, the operation is so delicate, that it requires a mechanic capable of working to the 64th of an inch, or less, to make these plates properly, which, of itself, is very expensive.

On the vibrator machine the same difficulties occur. In using this machine a match plate for the cope and drag have to be made, and these would have to be machined to a surface, and the patterns placed thereon. This could not be made in the form of an ordinary match plate, such as we are familiar with in the stove trade, but would have to be started from a level plate, planed to absolute thicknesses, and then the drag or cope pattern placed on and fastened to this plate with the necessary partings. The same operation would have to be gone through with both cope and drag, and all parts brought into prefect alignment. Therefore, I would repeat, that there is no form of machine, to our knowledge, in which the expense of rigging up for the machine would not be so great, that, unless there was at least 60 full consecutive days' work for the machine on one pattern, it would be of any economic value whatsoever.

It is claimed, and is possibly true, that some of the large pieces of stoves made in bound flasks, could also be made or used on the molding machine, but this would mean a large quantity of special flasks. To illustrate: If a molding machin be made capable of making 60 top flasks per day, there would have to be 60 special top flasks provided for this work, and these flasks, when not in use, as well as the patterns, would have to be cared for and stored, and, as the average number of tops, in the average-sized stove foundry, of any one size and style does ont exceed 600, this would leave but ten days' work for the machine, and the storage and care of 60 flasks and the match or stripping plates during the year.

Now, while these machines are highly recommended, and are adaptable for such articles as pipe fittings, car castings of different styles, hardware, where large quantities can be made, yet, everything depends upon the quantity. We know of one shop where molding machines are used, and where the minimum order given for castings from the machine was 5,000 molds, and in this shop their casting room for the storage of these castings occupies more space than the storage of their finished product. In fact, if my memory serves me right, they use a warehouse ground floor, 300x800 feet.

We have had our attention called to an Agricultural Shop in which, we have been credibly informed, there are 200 mowing machines made per day, all of one pattern. In this shop they use molding machines, and use them to great advantage, as well as economy, as the men work on one pattern day in, week in and month in, from one year's end to the other. And as some of these patterns are duplicated, taking two to a machine, they make as high as 400 castings from one pattern per day. These people use simply a stripping plate machine, as their flasks are barred and rammed by hand. They usually work their men in gangs, one gang making as high as 200 molds in one day.

The daily melt in this foundry is from 150 to 200 tons of iron, and yet we venture to make the assertion that there are more separate patterns in one line of ranges (comprising two sizes) than they have in this entire shop; and they claim their fittings for draw-plate molding alone has cost them upwards of $50,000.

There are, no doubt, advanced men in the stove trade who believe that they can utilize these machines in their shops, and there may be special features, peculiar to themselves and their work, which will enable them to do so, but we can but think that, in the majority of instances, it will mean time, brains and money expended without adequate results. The time may come (but it now seems very far distant) when molding machines can be used to advantage in stove plate molding; but that time can only come when such a consolidation of interest is made as will bring the 100 sets of patterns of one type of range now made down to one universal type made in one foundry, and under one management. When this millennium arrives then molding machines will be a feature of stove plate molding.

* Read at the meeting of the National Association of Stove Manufacturers, at Cincinnati, May 10, 1899.

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

The Milwaukee Electric Co. announces its incorporation for the manufacture and sale of electrical machinery and appliances. The officers are: Wm. P. Harper, president; Walter Cary, vice-president; H. W. Morris, secretary and engineer; John A. Whaling, treasurer—all formerly officers and employes of the Gibbs Electric Co., Milwaukee. Dynamos and motors of effective designs are manufactured and estimates furnished on electrical apparatus for lighting, driving machinery, etc. A repair shop is provided with complete equipment.

At Youngstown, O., the Youngstown Range & Stove Co. has been formed, with $10,000 capital. The directors are A. L. Pitney, Mason Evans, L. E. Cochran, John O. Pew, and G. M. McKelvey. The following were elected officers: President and general manager, John O. Pew; vice-president, A. L. Pitney; secretary and treasurer, Mason Evans. President Pew is manager of the Youngstown Iron & Steel Roofing Co., and the majority of stock is held by the stockholders in the latter company. The new company is to manufacture the gas heating stoves of the Calovit Heating Co., Brooklyn, N. Y., and Butler, Pa. The equipment of the Butler plant will be moved to Youngstown.

The Roth Gas Engine Co., of Indianapolis, Ind., has been incorporated with a capital stock of $50,000 by Charles C. Roth, G. W. Roth, Charles E. Barrett, Benjamin F. Haugh, and Christian F. H. Waterman.

The Cornell Machine Co., Chicago, capital stock $150,000; incorporators, Charles B. Cone, M. J. O'Kelley, and W. B. Ward, is a new company.

The Susquehanna Iron & Steel Co., which has applied for a Pennsylvania charter to capitalize at $3,000,000, expects to purchase the Columbia Rolling Mill, the plants of the Susquehanna Iron Co., Columbia Iron Co., and the York Rolling Mill, at York, Pa., besides the Aurora Furnace, at Wrightsville, Pa., and the Vesta Furnace, at Watts. The incorporators are: Senator Charles A. Porter, Dr. L. S. Filbert, Kennedy Crossan, James P. McNichol and William C. Martin, all of Philadelphia. The board of directors of the company will include General Patton, John Q. Denny, C. C. Kaufman, and John W. Steacy, of York. It is said that the transfer of the plants will be made about the first week in July.

New Construction:—

The B. F. Sturtevant Co., whose well-known "chimneyless" factory is situated at Jamaica Plain, near Boston, is making an addition to its large floor space for electrical work. Another story is being added to two of its shops, one 125 feet by 50 feet, and the other 100 feet square, both of which will be used for this purpose. The increase in this department has been great. The company is now making electric motors up to 125 h. p., and generators up to 100 k. w.

The Hazelton Boiler Co. has recently purchased a tract of land and will shortly commence the erection of a large plant, with modern equipment, for the manufacture of its boilers, stacks, tanks, and other kinds of sheet iron work, and general repairs to machinery.

At Girard, O., a site has been selected and work will begin at once on the new boiler plant promoted by Frank Clipp. Incorporation papers are being prepared.

The extensive manufacturing buildings the Crane Co., of Chicago, will erect on West 12th st., will extend over 10 lots and will cost $125,000.

At St. Paul a building permit has been issued to C. A. Stickney for a machine shop on Starkey st., near Fillmore ave., to cost $8,000.

Important additions are to be made to the Studebaker Bros. Mfg. Co.'s plant, of South Bend, Ind., at a cost of several hundred thousand dollars. It is reported that the company has closed $1,000,000 worth of contracts for the construction of automobiles.

The Garry Iron & Steel Roofing Co., of Cleveland, has been granted a permit for a $15,000 building.

The Warren City Boiler Co., Warren, O., is building an addition 50x100 feet and is also putting in a new boiler house. It has just put in a complete compressed air plant for operating riveters, calking and hoisting machines, and has put in a new traveling crane 48 feet span, which covers the main boiler floor.

The Inland Steel Co., Chicago Heights, Ill., is erecting an addition to its harrow tooth department. The building will be 25x150 feet, one story.

At Oshkosh, Wis., the Barnes Machine Co., which was burned out recently, has decided to rebuild its plant, at an expenditure of $60,000.

Geo. Pugh is building an addition to his foundry at Kansas City, Mo., 55 feet long, making it 105x140 feet. This will make his capacity 20 tons of sash weights a day.

At the Kieckhefer plant of the National Enameling & Stamping Co., at Milwaukee an addition 200 feet square and four stories is to be erected.

The Buckeye Malleable Iron & Coupler Co., Columbus, has purchased 36 acres of ground near the National Steel Co.'s plant in that city. In the fall it is the purpose to begin the erection of a large malleable plant.

Fires and Accidents:—

At Conshohocken, Pa., the Longmead Iron Works were damaged $10,000 by fire.

The Vulcanus Forging Co.'s plant, Cleveland, O., was damaged by fire May 31. Loss $15,000, partly insured. The company started operations about two months ago.

Power Equipment and Machine Tools:—

The Lidgerwood Mfg. Co., New York, manufacturer of improved hoisting engines and suspension cableways have recently established a branch at Atlanta, Ga., with offices in the Prudential Building. This is the finest office building in Atlanta, if not in the entire South. The Atlanta branch will be in charge of J. H. Dickinson, C. E., sales agent.

The Scottdale Iron & Steel Co., Ltd., Scottdale, Pa., is installing 1,250 h. p. Cahall water tube boilers.

The Hazelton Boiler Co., of New York, reports that its sales for last year exceeded those of the previous year about 75 per cent, with a steadily increasing demand all over the country and abroad. The Hazelton Boiler Co. is executing a number of important orders, and its list of recent sales includes the Goodyear's India Rubber Glove Co., Naugatuck, Conn.; North Adams Gas Light Co., North Adams, Mass.; the S. O. & C. Co., Ansonia, Conn.; Lester-Shire Mfg. Co., Boston, and Lester Shire, N. Y.; John Royle & Sons, Paterson, N. J.; the New York Mutual Gas Light Co., New York, and the American Sugar Co., Molokai, Hawaiian Islands. All of the above boilers are of large size and will have brick-lined steel jackets, which is the new style of setting for this boiler, and the subject of patents owned by its makers.

The Manistee Iron Works, Manistee, Mich., has recently completed a very large air pump. The steam cylinder is 27 inch diameter by 72-inch stroke, and the two air cylinders are each 42-inch diameter and 36-inch stroke. The weight of the pump is 30 tons, and is said to be the largest independent air pump in the world.

Taking effect June 1, the Cahall Sales Department, Pittsburg, made an advance of 10 per cent in Cahall boilers.

The Chicago District:

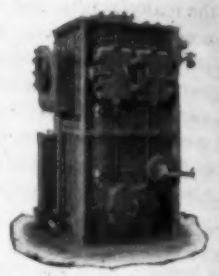
Forster, Waterbury & Co., of Chicago, the well-known dealers in pig iron, steel, ore and coke, have purchased about 10 acres of land at the junction of the C. M & St. P. and Wisconsin Central Road, Franklin Park, Ill., and will also have connection with the Chicago T. T. Ry. and Chicago J. R. R. Plans and specifications have been prepared for the erection of buildings having an annual capacity of 8,000 to 10,000 tons of malleable and gray iron castings. Construction will be commenced immediately, and it is expected that the works will be in operation by Aug. 1, next. Among the specialties will be wagon skeins, Waterbury patent vehicle steel wheel, steel fence posts, and malleable link belt. The plant will be equipped in addition to make general agricultural and car malleables. The city office will be 1200-1 No. 355 Dearborn st., Chicago.

J. J. Ryan & Co., 68 to 74 W. Monroe st., report that business in all their lines continues exceptionally good. They have had orders in the past month for a number of heavy phosphor bronze bearings. Some of these were for the F. W. Wolff Co.,

Great Scott!!

Is there any fellow making steam for power purposes who has so much "money to burn" that he has not put in a Feed-water Heater?

Any man who has exhaust steam going to the atmosphere, who is not provided with a Heater must be quite indifferent to the end the rest of us are striving to attain. We would like to meet him. The chances are that we would make that man a proposition, with our gnarantee back of it—the chances are that we would sell him a **Cochrane Heater,** and if we did—well, to be right frank—that Heater would make anywhere from four to twenty times as much money for him as we would make out of it; but then we would be satisfied with our regular manufacturers' profit, and we would always have him for a friend.



There are plants that ought to have a feed-water heater—others that ought to have a new feed-water heater—all ought to have a COCHRANE FEED-WATER HEATER.

HARRISON SAFETY BOILER WORKS,

Mfrs. of the Cochrane Heaters. **Clearfield and 17th Sts., Philadelphia, Pa**

Chicago, and the American Steel & Wire Co., weighed upward of 400 pounds each and others 550 pounds each. Orders for heavy bronze castings had been coming so close together, that the company has been obliged to tear out most of its old furnaces and replace them by others large enough to give the required tonnage. Business in aluminum castings is assuming important dimensions also. Alloys of this metal with copper are now being made, developing the same strength practically as cast iron, with a specific gravity only a trifle above that of pure aluminum. J. J. Ryan & Co. have just finished a large order for the Otis Elevator Co., in this metal. The patterns are all in platser of paris, originally modeled in wax and of varied and elegant designs. There were Corinthian columns 7 feet long with panels and reliefs in harmonious relations. The total weight amounted to about 1,000 pounds. The prospect for the immediate future is reported equally encouraging, one single order for a carload of brass castings for July delivery aggregating 26 000 pounds. Trade in Babbitt metals has been increasing so steadily that the company is enlarging its facilities, and taking on sufficient space to make its productive capacity 50 per cent greater than at present.

Arrangements are being made by the new owners of the Calumet Rolling Mill, at Cummings, Chicago, to have the machinery overhauled and put in condition for resuming operations at an early day in the manufacture of bar iron. The mill will be run as an independent enterprise.

General Industrial Notes:—

The We Fu Go Co., of Cincinnati, has erected an enlarged water softening plant for the Weir Frog Co., of Cincinnati, making this company's capacity 48.000 gallons. It has also made an enlargement for the McDougall Steam Laundry, of Denison, Tex., capacity 14,400 gallons, and an enlargement for the Brenham Compress, Oil & Mfg. Co., of Brenham, Tex. capacity 72,000 gallons. The Cincinnati company has also put in a water softening plant for the Beckett Paper Co., of Hamilton, O., capacity 33,600 gallons. For Westinghouse, Church, Kerr & Co., it has installed a water softening plant at the Galesburg Artificial Ice Co., Galesburg, Ill., capacity 28,800 gallons. For the Peerless Laundry, Carthage, Mo., a plant having a capacity of 7,200 gallons, has been put in, and for the Temple Cold Storage & Ice Factory, of Temple, Tex., a plant of 19,200 gallons capacity. The We Fu Go Co. has compiled a list of users of its softening plants, with letters giving their experiences. This is sent on application.

The executive committee of the United States Cast Iron Pipe & Foundry Co. has decided to operate the pipe department of the plant at West Superior, Wis., to full capacity.

The Chester Rolling & Sheet Mill Co., East Liverpool, O., is reported to have paid $80,000 for a tract of land recently acquired at that city.

The Falcon Iron & Nail Co. has abandoned for the present the plan for three new sheet mills at Niles, O.

Puddlers in the rolling mill department of the Pennsylvania Bolt & Nut Works, Lebanon, Pa., now receive $3.25 a ton, after three 25-cent advances.

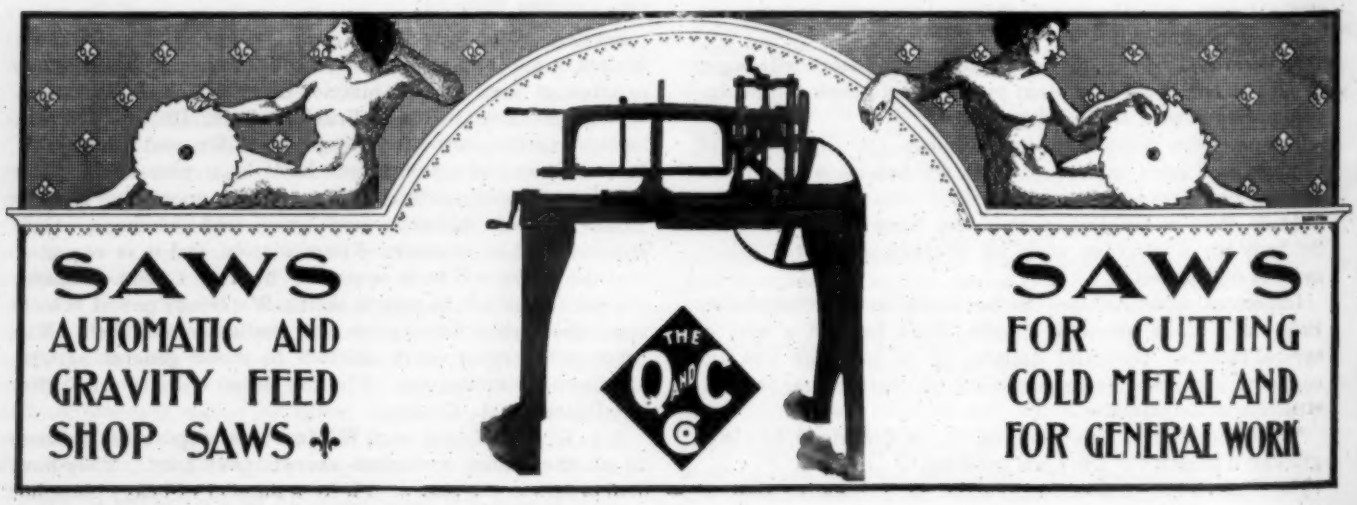
Valentine Furnace at Bellefonta, Pa., just started up by the Empire Iron & Steel Co., had been out of blast for nearly three years.

The Lorain Steel Co. has ordered 40 hopper-bottom gondola cars from the Pressed Steel Car Co.

The plate mill of the North Branch Steel Works, Danville, Pa., has started up.

The Akron Mining, Milling & Mfg. Co., of West Pulman, Ill., has bought the plant of the defunct Hercules Iron Works, in Auroa, Ill., and will move to Aurora.

The Tidewater Steel Co., Chester, Pa., announces that it has secured a plate mill to take the place of the one sold from the old Wellman plant for shipment to Russia two years ago.



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The mill in question will soon be removed to Chester, and it is expected will be in operation in 60 days. Meantime there is a surprising amount of activity in Tidewater stock in Philadelphia, when it is considered that there is no plant in operation.

One of the four furnaces of the Maryland Steel Co., at Sparrow's Point, Md., is banked on account of scarcity of Cuban ore and another stack is out.

Satisfactory tests have been made of the new blooming mill of the Lorain Steel Co., at Lorain, O. The first of the two new furnaces is expected now to go in blast about July 1. Work on rebuilding the dam for the blast furnace reservoir is going ahead as rapidly as possible. There are now employed in all departments of the works and on construction 3,700 men.

The Sterling Emery Wheel & Mfg. Co, Tiffin, O, has made a number of important improvements in grinding machinery, and has enlarged its productive capacity by the addition of extra tools. Trade is excellent, the company running until 9 o'clock nights. The foreign trade is increasing, some heavy shipments having been made recently. Additions to the present plant will be made in the coming summer.

The Cambria Iron Co., Johnstown, Pa., had the largest pay roll last Saturday in its history. The amount for the half month was $191,000, which was distributed among 7,000 employes. This was at the rate of over $4,500,000 a year.

At Muncie, Ind., the Palmer Steel & Iron Co.'s plant, the old Darnell Rolling Mill, started up this week. About 150 men were secured in Pennsylvania and New York.

The May output at the Ohio plant of the National Steel Co., Youngstown, O., was 43,850 tons of billets and sheet bars. Steel billets, large, 11,484 tons; small, 14,360 tons; sheet bars, 18,006 tons. The converting mills in 4,713 heats supplied 48,074 tons of material for the finishing department.

Work on the old Phoenix furnace of the Brown-Bonnell Iron Co., at Youngstown, O., recently begun, was discontinued by the Republic Iron & Steel Co. It is proposed to make more extensive improvements than at first contemplated, and

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until the new management has time to determine what these will be work will be suspended.

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The return limit on the low fare excursion tickets to Atlantic City, Cape May, Avalon Anglesea, Holly Beach, Ocean City, Wildwood, Sea Isle City, New Jersey, Rehoboth, Delaware, and Ocean City, Md., to be sold Aug. 10th, from principal stations on the Pennsylvania Lines will be Fifteen Days, including date of purchase. This is a longer limit than that granted on similar tickets sold in previous seasons, and will be ample for a delightful sojourn at the seaside. The extreme return limit will be Aug. 24th, which will allow a week after returning home to prepare for school and other duties which begin with the opening of September.

The date of the excursion, Aug. 10th, is the most convenient for an outing. Business is quiet at this season, crops are gathered, and office, store and farm duties are not exacting. The thermometer usually reaches the highest point about this time. It will be a pleasing diversion to spend a week's vacation in the invigorating ocean breeze and experience the unlimited pleasures at the command of the summer idler by the sea.

The round trip rate from Cleveland will be $13.50. Tickets at this exceptional low fare may be secured to either of the ten resorts mentioned above, which are the most attractive along the Atlantic coast. For illustrated descriptive matter about them apply to C. L. Kimball, Assistant General Passenger Agent, Cleveland, O.

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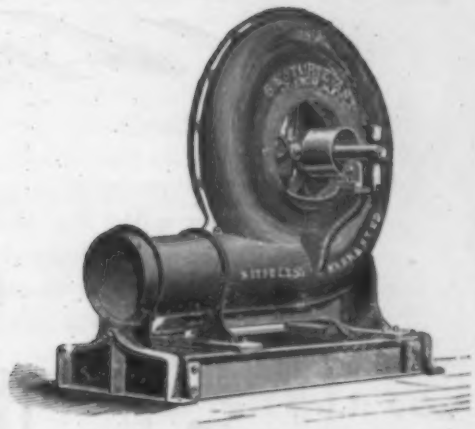

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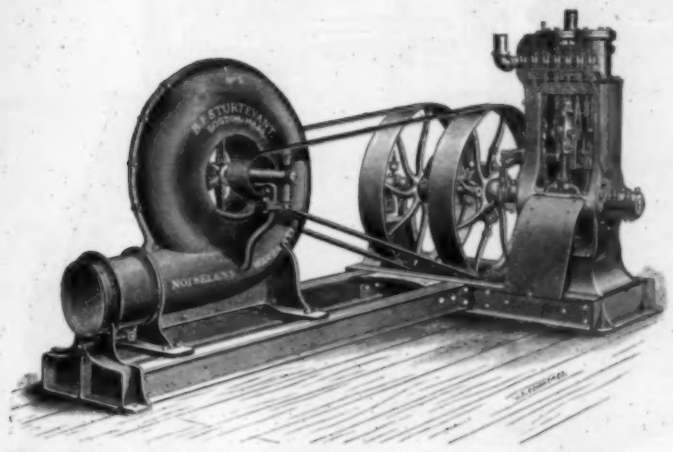

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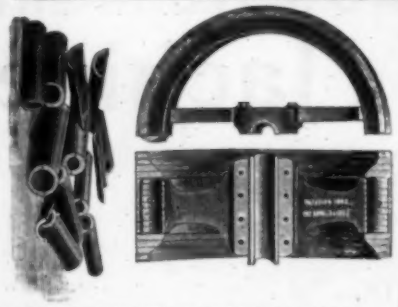

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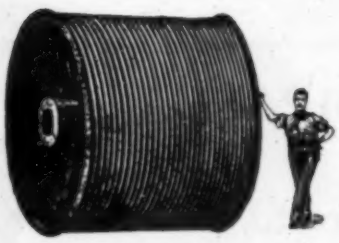

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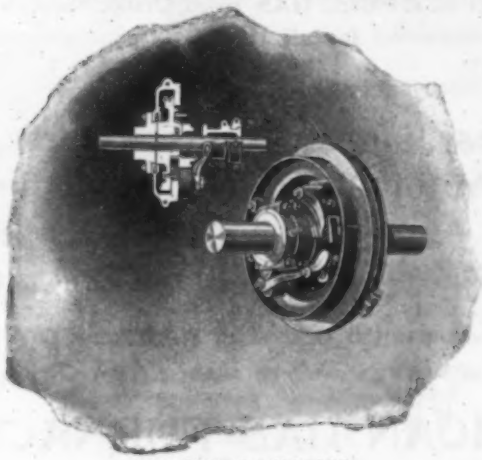

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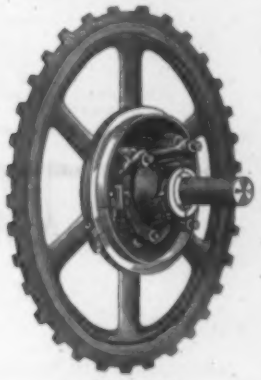

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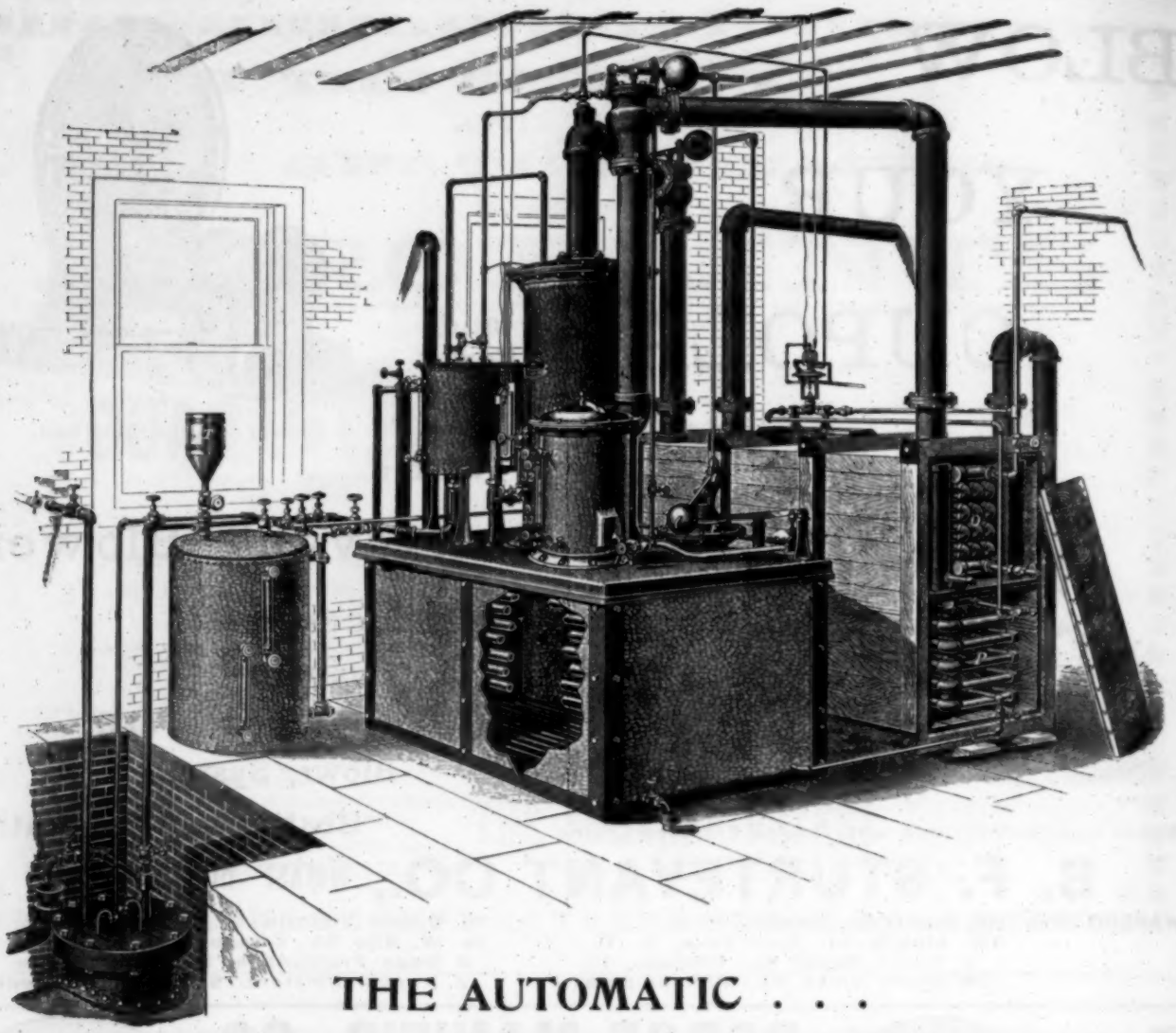

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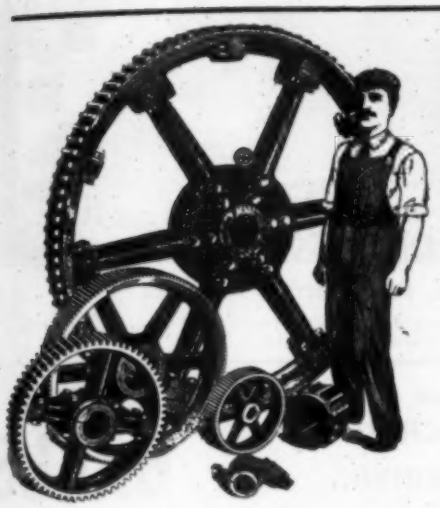

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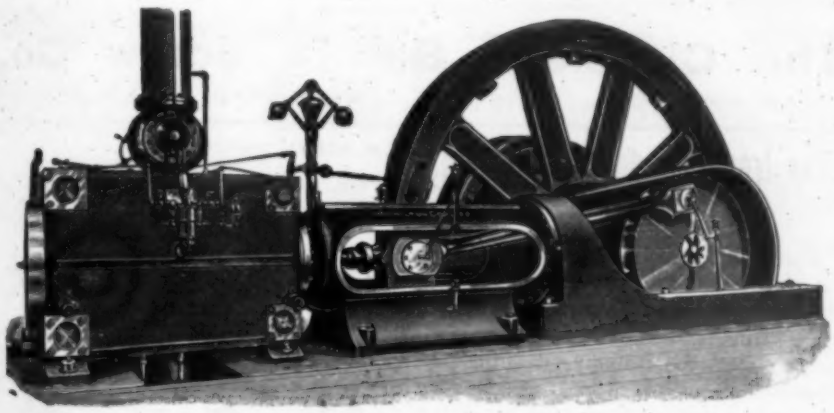

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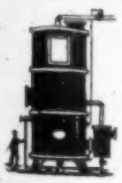

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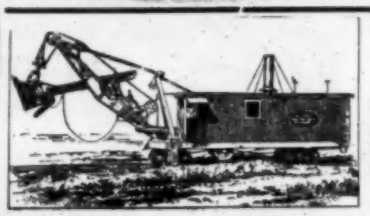

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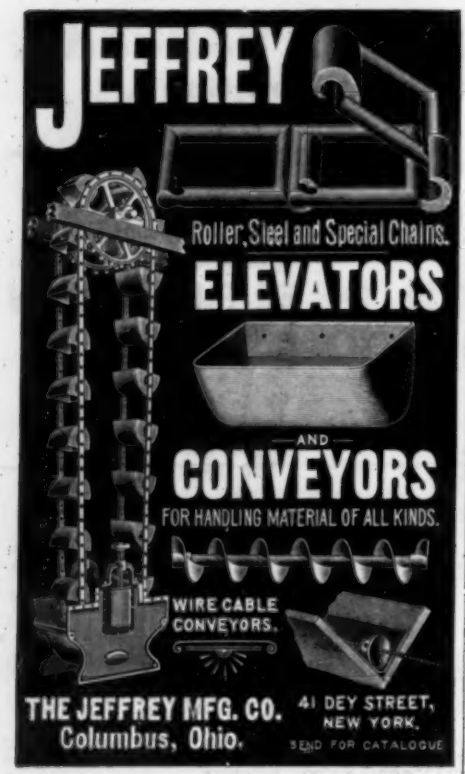

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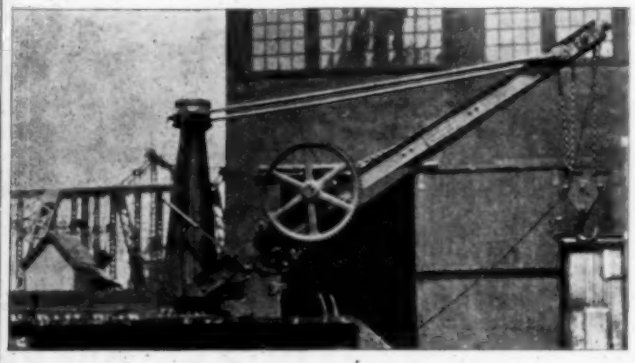

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Valley Jctn. & Way Stations..	*6:25 P M	*7:25 A M
Wheeling & Chicago.....	*9:25 P M	†7:25 A M
Akron, Canton & Chicago.....	*8:05 A M	*10:00 P M
Akron, Canton & Wheeling	*10:20 A M	*3:30 P M
Akron, Canton & Chicago	*8:05 A M	*6 35 P M
Akron, Canton & Marietta ...	†2:10 P M	†11:00 A M
Pittsburg, Washington, D. C. & Baltimore.....	*10:30 A M	*3:25 P M

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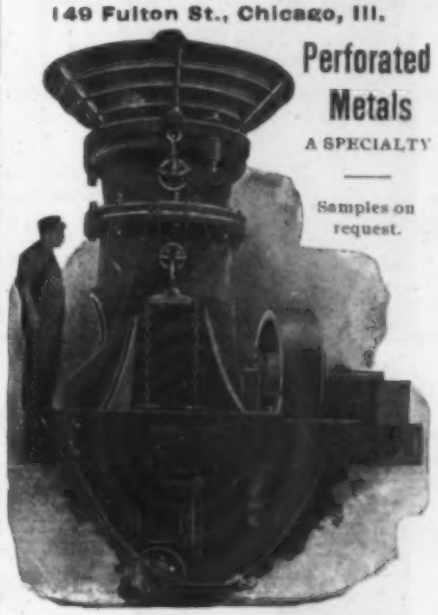

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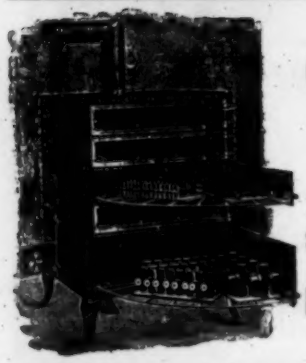

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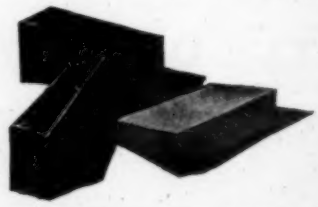

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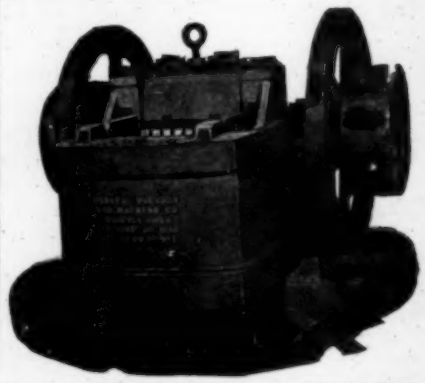

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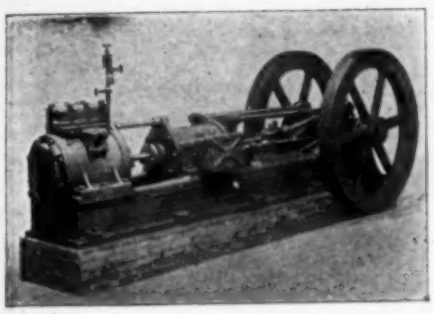

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Cleveland Depot: Foot of South Water Street.
Elyria Depot: Huron St., West Side.

South Bound.			Central Standard.		North Bound.	
15	13	11	Lorain Branch	12	14	16
P.M.	P.M.	A.M.	LV. AR.	A.M.	A.M.	P.M.
4:25	2:25	6:27	Lorain	9:15	11:35	7:30
4:40	2:30	6:44	Elyria	9:00	11:21	7:16
4:56	2:55	7:04	Grafton	8:43	11:07	6:58
5:15	3:12	7:23	Lester	8:25	10:50	6:40
5	3	1	Main Line	2	4	6
5:30	2:25	7:20	Cleveland	8:30	11:50	7:15
5:47	2:41	7:36	Brooklyn	8:14	11:34	7:01
6:42	3:26	8:22	Lester	7:29	10:49	6:19
6:52	3:35	8:30	Medina	7:16	10:37	6:07
7:05	3:46	8:41	Chippewa La	7:04	10:26	5:55
7:20	4:01	8:56	Sterling	6:48	10:13	5:40
8:09	4:46	9:45	Massillon	6:00	9:23	4:54
8:55	5:31	10:34	Canal Dover.	5:11	8:36	4:10
9:02	5:38	10:41	New Philade	5:04	8:28	4:03
9:20	6:05	11:25	Uhrichsville	4:45	8:10	3:45
.....	8:10	1:30	Bridgeport	.....	6:05	1:40
.....	8:25	.....	Bellaire	.....	5:50	.....
P.M.	P.M.	P.M.	AR. LV.	A.M.	A.M.	P.M.

No. 9 leaves Lorain 9:50 a.m., Elyria 10:05, Grafton 10:21; arrives Lester Junction 10:40. No. 10 leaves Lester Junction 3:25 p.m., Grafton 3:42, Elyria 3:57; arrive Lorain at 4:10 p.m.

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Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

Engravers and Electrotypers—
Central Electrotype & Engraving Co., Cleveland, O.
National Engraving Co., Cleveland, O.,

Exhaust Heating Apparatus—
B. F. Sturtevant Co., Boston, Mass.

Fans—
American Gas Furnace Co., New York City.
B. F. Sturtevant Co., Boston, Mass.

Feed Water Heaters and Purifiers—
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Harrison Safety Boiler Works, Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.

Files, Makers of—
C. H. Besly & Co., Chicago, Ill.

Fire Brick and Clay—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt. Savage, Md.
Clearfield Fire Brick Co., Clearfield,
Dover Fire Brick Co., Cleveland. Pa.
F. B. Stevens, Detroit, Mich.
The S. Obermayer Co., Cincinnati. O.
Chicago Fire Clay Product Co., Chicago, Ill.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Detroit, Mich.
Garden City Sand Co., Chicago, Ill.

Fire Proof Covering—
C. H. Besly & Co., Chicago, Ill.

Flexible Shafts—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

Flue Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

Foot and Power Lathes—
U. Baird Machinery Co., Pittsburg, Pa.
Edwin Harrington Son & Co., Philadelphia, Pa

Foundries—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
The Lane & Bodley Co., Cincinnati, O.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago.
Jeffrey Mfg. Co., Columbus. O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.
Riverside Foundry Co., Cleveland, O.
I. & R. Greenwald Co., Cincinnati, O.
Wheeling Mold & Foundry Co., Wheeling, W.Va.
Excelsior Iron Works Co., Cleveland, O.

Foundry Equipments—
The S. Obermayer Co., Cincinnati, O.

Foundry Supplies—
Clearfield Fire Brick Co., Clearfield, Pa.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O.
Tabor Mfg. Co., Elizabeth, N. J.
F. B. Stevens, Detroit, Mich.
Millett Core Oven Co., Brightwood, Mass.
Cleveland Facing Mill Co., Cleveland. O.
The S. Obermayer Co., Cincinnati, O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Clay Product Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O.
Ætna Fire Brick Co., Oak Hill, O.
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
Holmes, Strachan & Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

Foundry Facings—
The S. Obermayer Co., Cincinnati, O.
Cleveland Facing Mill Co., Cleveland, O.

Forgings—
Cleveland City Forge & Iron Co., Cleveland, O.
Bethlehem Iron Co., South Bethlehem, Pa.
Bræburn Steel Co., Braeburn, Pa.
Wyman & Gordon, Worchester, Mass.

Friction Metal—
C. H. Besly & Co., Chicago, Ill.
Swarts Metal Refining Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.

Furnaces—
Playford Stoker Co., Cleveland, O.

Furnace Linings—
Union Mining Co., Mt. Savage, Md.

Fuel Oil Burners—
W. S. Rockwell & Co., New York City.
American Gas Furnace Co., New York City.

Galvanized Iron—
Apollo Iron & Steel Co., Pittsburg, Pa.

Galvanisers—
Ætna-Standard Iron & Steel Co., Bridgeport, O.
Apollo Iron & Steel Co., Pittsburg, Pa.

Galvanizing Pots—
The Wm. B. Pollock Co., Youngstown, O.

Gas Burners—
American Gas Furnace Co., New York City.

Gas Furnaces—
American Gas Furnace Co., New York City.

Gauge Cocks—
James Bonar & Co., Pittsburg, Pa.

Gearing.
I. & R. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.

Gear Cutting—
The R. D. Nuttall Co., Allegheny. Pa
Brainard Milling Machine Co., Hyde Park, Mass.
The Van Dorn & Dutton Co., Cleveland, O.

Gear Cutters—
Brainard Milling Machine Co., Hyde Park, Mass.

Gear Lubricants—
The Ironsides Company, Columbus, O.

Grease—
A. F. Boettcher, Rowlands, Pa.

Grindstones—
C. H. Besly & Co., Chicago, Ill.

Graphite Paint—
Jos. Dixon Crucible Co., Jersey City N. J.,

Grate Bars—
Geo. B. Sennett Co., Youngstown, Ohio.

Gray Iron Castings—
W. A. Jones Foundry Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O
Brass Founders' Supply Co., Newark, N. J.

Hack Saws—
Millers Falls Co., New York City.
Q & C Co., Chicago, Ill.

Hangers—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & R. Greenwald Co., Cincinnati, O.

Harness Snaps—
Covert Mfg. Co., West Troy, N. Y.

Hoists—
Edwin Harrington Son & Co., Philadelphia.
Reading Crane & Hoist Works, Reading, Pa.
The Lane & Bodley Co., Cincinnati, O.
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

Heaters and Purifiers—
Harrison Safety Boiler Works, Philadelphia.
Stilwell-Bierce & Smith-Vaile Co., Dayto O.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Austin Separator Co., Detroit, Mich.

Heating and Ventilating Apparatus
B. F. Sturtevant Co., Boston.

Heavy Hardware—
C. H. Besly & Co., Chicago, Ill
Parkhurst & Wilkinson Co., Chicago, Ill.

Hoisting Engines—
The Edward P. Allis Co., Milwaukee, Wis.
Earle C. Bacon, New York City.
The Lane & Bodley Co., Cincinnati, O.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Excelsior Iron Works Co., Cleveland, O

Hoisting Machinery—
Link-Belt Machinery Co., Chicago, Ill.
Reading Crane & Hoist Works, Reading, Pa.
Jeffrey Mfg. Co., Columbus, O.
The Lane & Bodley Co., Cincinnati. O.
Excelsior Iron Works Co., Cleveland, O.
Earl C. Bacon, New York City.
Lidgerwood Mfg. Co., New York City.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.
Robins Conveying Belt Machine Co., New York City.

Horse Shoes—
Phoenix Horse Shoe Co., Joliett, Ill.

Hotels—
United States Hotel Co., Cleveland, O.

Hydraulic Machinery—
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

Impulse Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.

Ingot Molds—
Lorain Foundry Co., Lorain, O.

Injectors—
C. H. Besly & Co., Chicago, Ill.
Manning, Maxwell & Moore, New York City.
James Bonar & Co., Pittsburg, Pa.

Insurance Companies—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

Iron Buildings—
Shiffler Bridge Co., Pittsburg, Pa.
Riter-Conley Co., Pittsburg, Pa.

Iron Nails and Steel—
Bethlehem Iron Co., South Bethlehem, Pa.
C. H. Besly & Co., Chicago, Ill.
R. H. Stroud & Co., Chicago, Ill.
Parkhurst & Wilkinson Co., Chicago, Ill.

Iron and Steel Roofing—
Berger Mfg. Co., Canton, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.

Iron Ore—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
Drake Bartow & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.

Iron Working Tools—
H. Bickford, Lakeport, N. H
C. H. Besly & Co., Chicago, Ill.
The F. B. Shuster Co., New Haven, Conn.
U. Baird Machinery Co., Pittsburg, Pa.
Fox Machine Co., Grand Rapids, Mich.
Armstrong Bros. Tool Co., Chicago, Ill.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Skinner Chuck Co., New Britain, Conn.
Cleveland Tool & Supply Co., Cleveland, O.
Brainard Milling Machine Co., Hyde Park, Mass.
Baush & Harris Machine Tool Co., Springfield, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.
Cleveland Ball & Screw Co., Cleveland, O.
W. P. Davis Machine Co., Rochester, N. Y.

Link Belting—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

Ladles—
The S. Obermayer Co., Cincinnati, O.

Lathes—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Manning Maxwell & Moore, New York City.

Lubricators—
A. F. Boettcher, Rowlands, Pa.

Machinery Name Plates—
August Becker, Boston, Mass.

Machinists' Tools and Supplies—
W. P. Davis Machine Co., Rochester, N. Y.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Parkhurst & Wilkinson Co., Chicago, Ill.
Skinner Chuck Co., New Britain, Conn.
Cleveland Tool & Supply Co., Cleveland, O.
Baush & Harris Machine Tool Co., Springfield, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, New York City.

Machine Screws—
C. H. Besly & Co., Chicago, Ill

Machine Shops—
The R. D. Nuttall Co., Allegheny, Pa.
The Lane & Bodley Co., Cincinnati, O.
H. A. Streeter, Chicago, Ill.

Machinery and Tool Steel—
C. H. Besley & Co., Chicago, Ill.
Bræburn Steel Co., Braeburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Sanderson Bros. Steel Co., Cleveland, O.
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.

Magnesia Covering—
C. H. Besly & Co., Chicago, Ill.

Malleable Castings—
Acme Malleable Iron Works, Buffalo, N. Y.

Manufacturing Chemists.
We Fu Go Co., Cincinnati, O.

Manufactured Iron & Steel—
Bourne-Fuller & Co., Cleveland, O.
Cleveland Rolling Mill Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Parkhurst & Wilkinson Co., Chicago, Ill.
Ohio Steel Co., Youngstown, O.

Metal Bearings—
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
Merchant & Co., Inc., Philadelphia, Pa.
Swarts Metal Refining Co., Chicago, Ills.
F. R. Phillips' Sons Co., Philadelphia, Pa.

Milling Machines—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Fox Machine Co., Grand Rapids, Mich.
Brainard Milling Machine Co., Hyde Park, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Manning, Maxwell & Moore, NewYrok City.

Mining Machinery—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
Earle C. Bacon, New York City.
The Lane & Bodley Co., Cincinnati, O.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Wm. Cramp & Sons, Philadelphia, Pa.
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Robins Conveying Belt Co., New York City.
Excelsior Iron Works Co., Cleveland, O.

Mine Pumps—
F. M. Prescott Steam Pump Co., Milwaukee, Wis.

Molding Machines—
Tabor Mfg. Co., Elizabeth, N. J.

Molding Sand—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
S. Obermayer Co., Cincinnati, O.
Garden City Sand Co., Chicago, Ill.
Newport Sand Bank Co., Newport, Ky.

Molders' Tools—
The S. Obermayer Co., Cincinnati, O.

Name Plates—
August Becker, Boston, Mass.

Nickel Plating Outfits—
Northampton Emery Wheel Co., Chicago, Ill.

Nuts and Bolts
Upson Nut Co., Cleveland, O.

Oilless Bearings—
C. H. Besly & Co., Chicago, Ill.

Oil Burners—
W. S. Rockwell & Co., New York City.

American Gas Furnace Co., New York City.
Oil Cups—
C. H. Besly & Co. Chicago, Ill
James Bonar & Co., Pittsburg, Pa.
Oil Filters—
James Bonar & Co., Pittsburg, Pa.
Oil Pumps—
C. H. Besly & Co. Chicago, Ill.
Oil Separators—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.
Ore Crushers—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Ore Screens—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
Harrington & King Per. Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Packing—
C. H. Besly & Co. Chicago Ill.
Jenkins Bros., New York City
Paint—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.
Standard Paint Co., New York City.
The Shearer-Peters Paint Co., Cincinnati, O.
Pattern Works—
Gobeille Pattern Co. Cleveland O.
Perforated Sheet Metal—
Harrington & King Perforating Co., Chicago, Ill
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Pig Iron—
Clinton Iron & Steel Co., Pittsburg.
Forster, Waterbury & Co., Chicago, Ill.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Spearman Iron Co., Sharpsville, Pa.
The Brier Hill Coal & Iron Co., Youngstown, O.
Pickands, Mather & Co., Cleveland, O.
Pipe Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.
Pipe Covering—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
Pipe Cutting and Threading Machines—
The Armstrong Mfg. Co., Bridgeport, Conn.
Planers—
W. P. Davis Machine Co., Rochester, N. Y.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O
Manning, Maxwell & Moore, New York City.
Plates—
Enterprise Boiler Co., Youngstown, O.
Plumbago—
The S. Obermayer Co., Cincinnati, O.
Plumbers' and Gas Fitters' Supplies—
C. H. Besly & Co., Chicago, Ill.
Pneumatic Appliances—
Clayton Air Compressor Works, New York.
Pneumatic Tools—
American Pneumatic Tool Co., New York City
Q & C Co., Chicago, Ill.
Portable Forge—
C. H. Besly & Co., Chicago, Ill.
B. F. Sturtevant Co., Boston, Mass.
Vulcan Mfg. Co., Pittsburg, Pa.
Power Drop Hammers—
Baush & Harris Machine Tool Co., Springfield Mass.
Power Presses—
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Power Transmission Machinery—
Jeffrey Mfg. Co., Columbus, O.
The Lane & Bodley Co., Cincinnati, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
I. & E. Greenwald Co., Cincinnati, O.
Presses—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co. Chicago. Ill.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Pressure Gauges—
The Bristol Co., Waterbury, Conn.
James Bonar & Co., Pittsburg, Pa.
Pulleys—
W. A. Jones Foundry Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.
Pumps (Steam)—
The Edward P. Allis Co., Milwaukee, Wis
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Punches—
E. Konigslow & Bro. Cleveland, O.
Pyrometers—
Edward Brown, Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.
Railway Supplies—
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Rivets—
Champion Rivet Co., Cleveland, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
Riveted Steel Pipe—
The Wm. B. Pollock Co. Youngstown, O.
Rock Drills—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.
Rolling Mill Machinery.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.
Roofs—
Shiffler Bridge Co., Pittsburg.
Riter-Conley Mfg. Co., Pittsburg, Pa.
Sand and Chill Rolls—
Seaman, Sleeth Co., Pittsburg, Pa.
Saws—
Peter Gerlach & Co., Cleveland, O.
Screens for Coal Ore, Etc.
Robt. Aitchison Perforated Metal Co., Chicago.
Harrington & King Perforating Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Screws—
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.
Chicago Screw Co., Chicago, Ill
Screw Machines—
Cleveland Ball & Screw Co., Cleveland, O.
Seamless Tubes—
Shelby Steel Tube Co., Cleveland, O.
Separators—
Harrison Safety Boiler Works, Philadelphia, Pa.
Austin Separator Co., Detroit, Mich.
Shafting—
The Lane & Bodley Co., Cincinnati, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Fitzsimmons & Co., Cleveland, O.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
Jones & Laughlins, Ltd., Pittsburg, Pa
I. & E. Greenwald Co., Cincinnati, O.
Shapers—
W. P. Davis Machine Co., Rochester, N. Y.
Baush & Harris Machine Tool Co., Springfield, Mass.
Fox Machine Co., Grand Rapids, Mich.
Shearing and Punching Machinery—
Bertsch & Co., Cambridge City, Ind.
Fox Machine Co., Grand Rapids, Mich
Danielson Machine & Tool Co., Cleveland, O.
Sheet Iron—
Cleveland Rolling Mill Co., Cleveland, O.
Ætna-Standard Iron & Steel Co., Bridgeport, O.
E. H. Stroud & Co., Chicago, Ill.
Ship Yards—
Wm. Cramp & Sons, Philadelphia, Pa.
Special Machinery—
Edwin Harrington Son & Co., Philadelphia
Q & C Co., Chicago, Ill.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
E. Konigslow & Bro. Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Danielson Machine & Tool Co., Cleveland, O.
Stand Pipes—
The Wm. B. Pollock Co., Youngstown, O.
Steam Boiler Inspectors—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.
Steam Pipe and Boiler Covering—
C. H. Besly & Co., Chicago Ill.
Steam Packing—
C. H. Besly & Co., Chicago, Ill.
Steam Pumps—
Hall Steam Pump Co., Pittsburg, Pa.
Stilwell-Bierce & Smith-Vail Co., Dayton, O.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred. M. Prescott Steam Pump Co., Milwaukee, Wis.
Edw. P. Allis Co., Milwaukee, Wis.
Southwark Foundry and Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
Steam Separators—
James Bonar & Co., Pittsburg, Pa.
Steam Shovels and Dredges—
Marion Steam Shovel Co., Marion, O
The Bucyrus Co., South Milwaukee, Wis.
Steam Specialties—
C. H. Besly & Co. Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.
Steel—
Otis Steel Co., Cleveland, O.
E. H. Stroud & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Sanderson Bros. Steel Co., Cleveland, O.
Byron H. White, Chicago, Ill.
Steel Balls—
Cleveland Ball & Screw Co., Cleveland, O.
Steel Castings—
Otis Steel Co., Cleveland, O.
Q & C Co., Chicago, Ill.
Steel Plants—
The Wm. B. Pollock Co., Youngstown, O.
The Riter-Conley Co., Pittsburg, Pa.
Steel Blooms and Billets—
Cleveland Rolling Mill Co., Cleveland.
Bethlehem Iron Co., South Bethlehem, Pa.
Ohio Steel Co., Youngstown, Ohio.
The Lorain Steel Co., Lorain, O.
Jones & Laughlins, Ltd., Pittsburg, Pa.
Steel Stamps and Stencils—
J. H. Fleharty & Co., Cleveland, O.
Steel Tubes—
Shelby Steel Tube Co., Cleveland, O.
Stokers—
Playford Stoker Co., Cleveland, O.
Tanks—
Enterprise Boiler Co., Youngstown, O
Meehan Boiler & Construction Co., Lowellville, Ohio.
The Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.
Tank Cars—
The Wm. B. Pollock Co., Youngstown, O
Tin and Terne Plates—
E. H. Stroud & Co., Chicago, Ill.
American Tin Plate Company, Chicago, Ill.
Tin Plate Machinery.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
F. R. Phillips' Sons Co., Philadelphia, Pa.
Tool Steel—
C. H. Besly & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
Sanderson Bros. Steel Co., Cleveland, O.
Transmission Machinery—
Heyl & Patterson, Pittsburg, Pa.
Link-Belt Machinery Co., Chicago, Ill.
The Lane & Bodley Co., Cincinnati, O.
W. A. Jones Foundry & Machine Co., Chicago, Ill
Jeffrey Mfg. Co., Columbus, O
Dodge Mfg. Co. Mishawaka, Ind.
The Aultman Co., Canton, O.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.
Tubes—
National Tube Works, McKeesport, Pa.
Shelby Steel Tube Co, Cleveland, O.
Tube Cleaners—
Union Boiler Tube Cleaner Co., Pittsburg, Pa.
Tube Welding—
S. Fix Sons, Cleveland, O.
Tumbling Mills—
The S. Obermayer Co., Cincinnati, O.
Turnbuckles—
Cleveland City Forge & Iron Co., Cleveland, O.
Twist Drills—
C. H. Besly & Co., Chicago, Ill.
Twist Drill Cases—
Vulcan Mfg. Co., Pittsburg, Pa.
Valves—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City
Manning, Maxwell & Moore, New York City.
James Bonar & Co, Pittsburg, Pa.
Ventilating Fans—
B. F. Sturtevant Co., Boston Mass.
Vises—
Massey Vise Co., Chicago, Ill.
Water Softening Plants—
We Fu Go Co., Cincinnati, O.
Wire Coating,
The Ironsides Company, Columbus, O.
Wire Filler
The Ironsides Company, Columbus, O.
Wire Machinery—
The F. B. Shuster Co., New Haven, Conn.
S. W. Goodyear, Waterbury, Conn.
Wire Nails—
Cleveland Rolling Mill Co., Cleveland, O.
Wire Rope Coating.
The Ironsides Company, Columbus, O.
Wire Rope Filling.
The Ironsides Company, Columbus, O.
Wood Pulleys—
Dodge Mfg. Co., Mishawaka, Ind.
Wrought Pipe—
National Tube Works, McKeesport, Pa.

Alphabetical List of Advertisers.

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FINE TOOL STEEL AND FORGINGS. ALSO SPRING HAMMER, AND MACHINERY STEEL OF HIGH QUALITY. FINE OPEN-HEARTH STEEL.

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MORE WEAR from your tools

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NO TROUBLE

"It pays to use the most reliable tool steel in the market."

SANDERSON BROS. STEEL CO.

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COLD ROLLED STRIP STEEL
FLAT & COILED FOR STAMPING DRAWING BLANKING SPRINGS ETC
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Cleveland, Ohio, U. S. A.

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All standard and special grades.
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Wrtte us for prices always. It will pay you.

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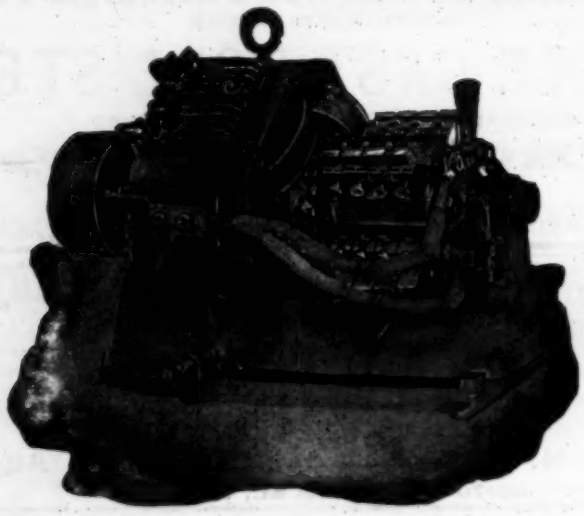

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EXCLUSIVE WESTERN SELLING AGENTS.

The **National Engraving Co.**

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CLEVELAND,
OHIO.

Advertisers who "keep everlastingly at it" win success.
That is the testimony of the shrewdest and livest of them.

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IRON ORE.

[On Lake Erie docks.]

Special low-phosphorus hard Ore, Bessemer	$4.50
No. 1 Specular, Bessemer	$3.50@4.25
No. 1 Bessemer hematite	3.00@4.00
Hematites No. 1 non-Bessemer	2.25@2.75
No 1. Specular, non-Bessemer	2.50@2.75
Mesabi Bessemer	2.50@3.00

PIG IRON.

CLEVELAND (f. o. b. cars):	
Bessemer	$16 65
No. 1 Strong Foundry	$16 75@17 00
No. 2 Strong Foundry	16 15@16 65
Gray Forge, red short	15 25@15 50
Gray Forge, neutral	15 15
No. 1 American Scotch	16 75@17 00
No. 2 American Scotch	15 15@16 65
Lake Superior Charcoal	17 00@18 00
PITTSBURG:	
No. 1 Foundry	$16 25@16 75
No. 2 Foundry	15 75@16 00
Gray Forge	14 75@15 00
Warm Blast Charcoal	18 00@19 00
Cold Blast Charcoal	24 00@26 00
Bessemer	17 00@17 50
CHICAGO:	
Lake Superior Charcoal	$17 00@$18 00
Local Coke Foundry No. 1	15 50@15 75
Local Coke Foundry No. 2	15 00@15 50
Local Coke Foundry No. 3	14 50@14 75
Local Scotch Foundry No. 1	15 50@15 75
Local Scotch Foundry No. 2	15 00@15 50
Local Scotch Foundry No. 3	14 50@14 75
Southern Coke No. 1	16 00@16 25
Southern Coke No. 2	15 25@15 75
Southern Coke No. 3	14 75@15 00
Southern No. 1 Soft	15 50@16 00
Southern No. 2 Soft	15 00@15 50
Southern Silveries	15 50@16 00
Jackson Co. Silveries	17 00@18 00
Ohio Silveries No. 1	@
Ohio Strong Softeners	15 50@16 50
Alabama Car Wheel	17 50@18 00
Malleable Bessemer	15 50@16 00
Coke Bessemer	15 50@16 00
CINCINNATI (reported by Rogers, Brown & Co.)	
Southern Coke No. 1, Foundry	$14 75@15 25
Southern Coke No. 2 and No. 1 Soft	14 25@14 75
Hanging Rock Charcoal No. 1, Fdy	17 00@18 00
Tennessee Charcoal No 1	15 00@16 00
Jackson County Silvery No 1	16 00@16 25
Southern Coke, Gray Forge	12 75@13 00
" " Mottled	12 75@13 00
Standard Georgia Car Wheel	15 50@16 00
Lake Superior " "	15 50@16 00
BUFFALO:	
No. 1 Foundry Strong Coke Iron Lake Superior Ore	$14 25
No. 2 Foundry Strong Coke Iron Lake Superior Ore	13 75
Ohio Strong Softener No. 1	14 00
Ohio Strong Softener No. 2	13 50
Jackson Co. Silvery No. 1	15 60
Southern Soft No. 1	15 25
Southern Soft No. 2	14 75
Lake Superior Charcoal	14 00@14 50
Coke, Malleable	14 10
ST. LOUIS:	
Southern Coke No 1	$14 75
Southern Coke No. 2	14 25
Southern Coke No. 3	13 75
Southern Coke No. 4	13 55
Southern Gray Forge	13 20
Tennessee Charcoal No. 1	13 75
Jackson County 2 per cent Silicon	16 25
Lake Superior Coke No. 1	15 00@16 00
Southern Car Wheel	15 25@16 25
Genuine Connellsville Coke	4 15
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OLD RAILS AND SCRAP METAL.

[Delivered Cleveland.]	Gross Tons
Old iron rails	$18 00
Old steel rails (6 ft. and over)	14 00
Old steel rails (6 ft. and under)	14 00
Old car wheels	16 00
	Net Tons
No. 1 R. R. wrought scrap	$16 50
Mill scrap	11 50
No. 1 Machine cast scrap	12 50
Iron axles	19 00
Axle turnings	11 00
Wrought turnings (free from cast)	10 00
Cast borings	7 50
Uncut wrought iron boilers	7 00
Steel boiler plates	11 00
Grate bars	8 00
Pipes and flues (clean)	10 00
Tank iron	12 00
Hoop and band iron	9 00
Sheet iron	8 00
Wrought drillings	10 00
Malleable iron	10 50

STRUCTURAL MATERIAL.

Beams and Channels (f. o. b. Cleveland)	1.60c
Angles	1.65c
Tees	1.65c
Universal Plates	2 25@2.35c
Sheared Plates	2.35c

MERCHANT IRON AND STEEL.

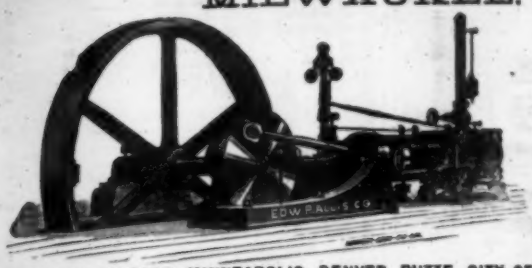
[Less than car-lots, Cleveland.]

Rounds and Squares.—Bar Iron.

1 to 1½	1.80 Base.
2 to 2½	.20 extra.
3 to 3½	.50 "
3½ to 4	.80 "
4½ to 4½	1.00 "
4½ to 5	1.30 "
5½ to 6	1.80 "
5½ to 6½	2.20 "

THE EDWARD P. ALLIS COMPANY

MILWAUKEE, WIS.



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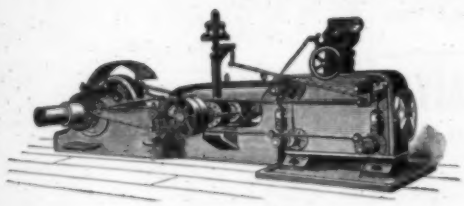

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ALL SIZES.

Simple and Compound.

Shafting, Hangers, Pulleys.

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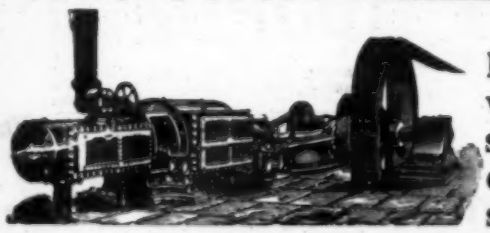

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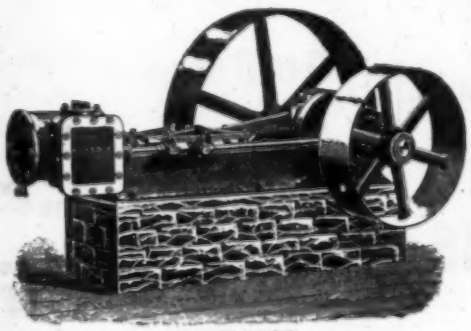

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A well made and durable center crank engine of from 20 to 40 h. p. The design is thoroughly modern and all parts are made in duplicate Engines kept in stock ready to run. Catalogues or prices willingly furnished. Among our other specialties are the

Sennett Compressed Couplings.

(See advertisement next week.)

Foundry contracts solicited for Castings from 10 lbs. to 5 tons each.

The Iron Trade Review

Pays special attention to iron ore, blast furnace, rolling mill, foundry and machine shop interests. Per year $3.00.

6¾ to 7¾	2.50 extra
¾ to ⅞	.10 "
7-8 to 11-16	.20 "
⅝ to 9-16	.30 "
7-16 to 15-32	.40 "
⅜ to 13-32	.50 "
5-16 to 1-32	.70 "
¼ to 9-32	.90 "
7-32	1.40 "
3-16	2.50 "

Flats.—Bar Iron.

1¼ to 4 x ⅜ to 1	1.65 Base
4¼ " 6 x ⅜ to 1	.10 extra
6¼ " 8 x ⅜ to 1	.60 "
8¼ " 10 x ⅜ to 1	.80 "
1⅜ " 4 x 1 1-16 to 1½	.30 "
4¼ " 6 x 1 1-16 to 1½	.40 "
6¼ " 8 x 1 1-16 to 1½	.60 "
8¼ " 10 x 1 1-16 to 1½	.90 "
2 to 4 x 1⅝ to 2	.50 "
4¼ " 6 x 1⅝ to 2	.60 "
6¼ " 8 x 1⅝ to 2	.80 "
8¼ " 10 x 1⅝ to 2	1.00 "
2 to 4 x 2⅛ to 3	.60 "
4¼ " 6 x 2⅛ to 3	.80 "
6¼ " 8 x 2⅛ to 3	1.00 "
1⅜ " 1¾ x ⅜ to 1	.10 "
1 to 1 1-16 x ⅜ to ⅝	.20 "
⅝ to 15-16 x ⅜ to ⅝	.40 "
7-8 to 11-16 x ⅜ to ⅝	.50 "
⅛ to 9-16 x ⅜ to ⅝	.90 "

Heavy Band Iron.

7 to 10 x ¼ to 5-16	.70 extra.
6¼ to 6¾ x ¼ to 5-16	.50 "
4¼ to 6 x ¼ to 5-16	.30 "
1⅜ to 4 x ¼ to 5-16	.20 "
1 to 1¾ x ¼ to 5-16	.30
¼ to 15-16 x ¼ to 5-16	.50 "
7-8 to 11-16 x ¼ to 5-16	.80 "
⅛ to 9-16 x ¼ to 5-16	1.00 "
⅜ to 7-16 x ¼ to 5-16	1.50 "

Heavy bands, 7-32 in. thick 1-10 c. per lb. higher than ¼ to 5-16 thick. Bevel Edge Shaft Iron 1-10 higher than same size of Heavy Bands.

Light Band Iron.

7 to 8 x No. 9 to 3-16	.90 extra
7 to 8 x Nos. 10, 11 and 12	1.00 "
6¼ to 6¾ x No. 9 to 3-16	.70 "
6¼ to 6¾ x Nos. 10, 11 and 12	.80 "
4¼ to 6 x No. 9 to 3-16	.50 "
4¼ to 6 x Nos. 10, 11 and 12	.60 "
1¼ to 4 x No. 9 to 3-16	.40 "
1¼ to 4 x Nos. 10, 11 and 12	.50 "
1 to 1 3-16 x No. 9 to 3-16	.50 "
1 to 1 3-16 x Nos. 10, 11 and 12	.60 "
13-16 to ⅞ x No. 9 to 3-16	.60 "
13-16 to ⅞ x Nos. 10, 11 and 12	.70 "
11-16 to ¾ x No. 9 to 3-16	.80 "
11-16 to ¾ x Nos. 10, 11 and 12	.90 "
9-16 to ⅝ x No. 9 to 3-16	1.00 "
9-16 to ⅝ x Nos. 10, 11 and 12	1.10 "
7-16 to ½ x No. 9 to 3-16	1.30 "
7-16 to ½ x Nos. 10, 11 and 12	1.40
⅜ x No. 9 to 3-16	1.50
⅜ x Nos. 10, 11 and 12	1.60

Bevel Edge Box Iron.

Same as Light Bands, of same sizes.

Beaded Band Iron, 1¼ in. to 2 in.

Sand Band Iron, 1-10 c. above same sizes of Light Bands.

Oval Iron.

⅜ to 1¼	.40 extra
½ to 13-16	.50 "
⅝ to 11-16	.60 "
¼ to 9-16	.80 "
¾ to 7-16	1.10 "
¼ to 9-16 x 3-16	1.00 "
¾ to 11-16 x ¼	1.20 "

Half Oval and Half Round.

2¼ to 3	.60 extra
⅞ to 2	.50 "
¼ to 13-16	.70 "
⅝ to 11-16	.90 "
½ to 9-16	1.20 "
⅜ to 7-16	2.50 "
5-16	3.50 "
¼	4.50 "

Half Ovals less than ¼ their width in thickness, extra price.

Horse Shoe Iron.

All sizes 1 c. extra.

Cutting ordinary bars to specified length, .20 to .50 extra, according to length and size.

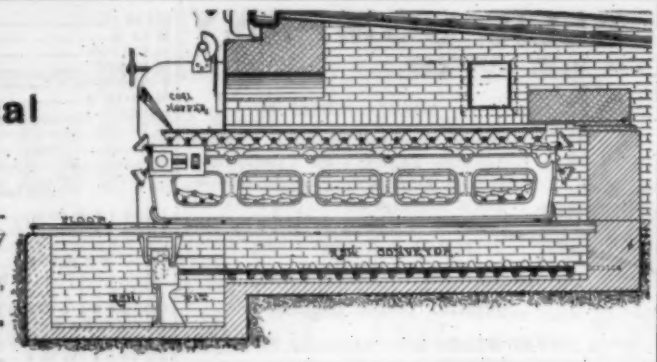
Steel Bands.

Width In Inches.	English Standard Gauge.		
1 1-2 to 6,	Nos. 7, 8, 9 or 3-16 "	1.50	Base.
			Extras.
1¼ to 6,	" 10, 11, 12 or ¼"	.85	per 100 lbs.
1 to 1¾,	" 7, 8, 9 or 3-16"	.10	"
1 to 1¾,	" 10, 11, 12 or ¼"	.15	"
13-16 and ⅞,	" 7, 8, 9 or 3-16"	.20	"
13-16 and ⅞,	" 10, 11, 12 or ¼"	.25	"
11-16 and ¾,	" 7, 8, 9 or 3-16"	.30	"
11-16 and ¾,	" 10, 11, 12 or ¼"	.35	"
9-16 and ⅝,	" 7, 8, 9 or 3-16"	.40	"
9-16 and ⅝,	" 10, 11, 12 or ¼"	.45	"
½,	Nos. 7, 8, 9 or 3-16"	.55	"
½,	" 10, 11, 12 or ¼"	.60	"
7-16	" 7, 8, 9 or 3-16"	.75	"
7-16	" 10, 11, 12 or ¼"	.85	"
⅜,	" 7, 8, 9 or 3-16"	.95	"
⅜,	" 10, 11, 12 or ¼"	1.05	

Iron and Steel Hoops.

Width Inches.	English Standard Gauge.		
7-16 to 3	Nos. 13, 14, 15 and 16	1.60	Base
			Extras.
7-16 to 2,	" 17, 18, and 19	.85	per 100 lbs
7-16 to 2,	" 20	.10	"
7-16 to 2,	" 21	.15	"
7-16 to 1¾,	" 22	.25	"
¼ to 1¾,	" 13, 14 and 15	.05	"
¼ to 1¾,	" 16, 17 and 18	.10	"

The Playford Mechanical Stoker



Guaranteed to
Abolish smoke, to increase boiler capacity and to save fuel.
For information, address,
The Playford Stoker Co.
404 Telephone Bldg.,
CLEVELAND, OHIO.

IRON CLAD PAINT CO.

Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g,
CLEVELAND, OHIO.

ORDER DIRECT FROM THE
Iron Clad Paint Co.

And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.

IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.

FURNISHED both Dry and Ground in Oil

USED BY NEARLY ALL THE RAILROADS.

We Claim The Following Merits for Jenkins Bros.' Valves

1. Manufactured of the best Steam Metal.
2. No regrinding, therefore not constantly wearing out the Seat of the Valves.
3. Contain JENKINS DISC, which is suitable for all Pressures of Steam, Oil and Acids.
4. The Easiest Repaired, and all parts Interchangeable.
5. Every Valve Tested before leaving the factory.
6. ALL GENUINE stamped with Trade Mark,

(2)

JENKINS BROTHERS, NEW YORK, PHILADELPHIA, CHICAGO, BOSTON

Dixon's Pure Flake Graphite

Is a Blessing to Every Engine Room and Machine Shop.
A small quantity added to any Oil or Grease largely increases its lubricating value and makes the finest Cooling Mixture.
Pamphlet and Sample Sent Free.
JOS. DIXON CRUCIBLE CO., Jersey City, N. J.

FOR GREAT TENSILE STRENGTH, ELASTICITY AND ELONGATION, COUPLED WITH UNUSUAL NON-CORROSIVE QUALITIES,

Castings and Propeller Wheels

MADE FROM

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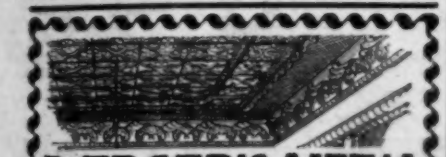

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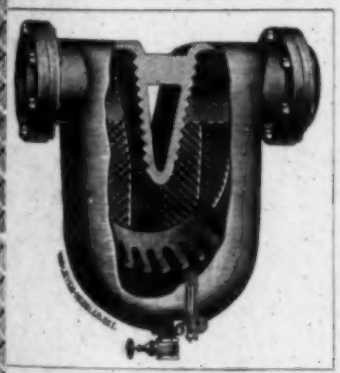

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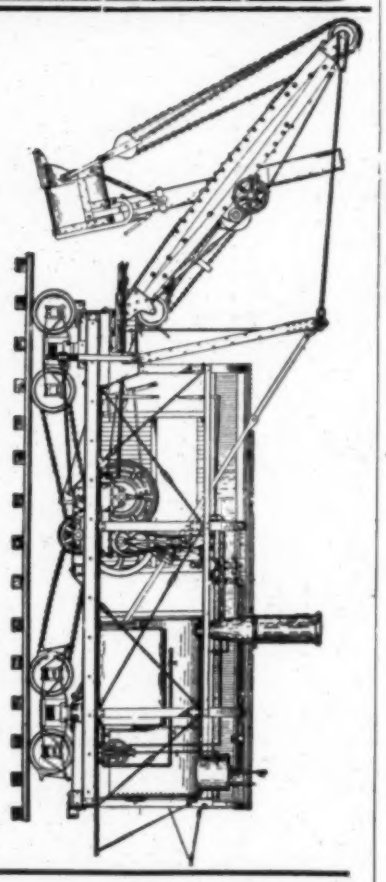

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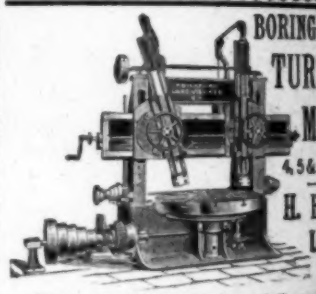

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